Railway Mechanical Engineer

May 1941

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RAILWAY
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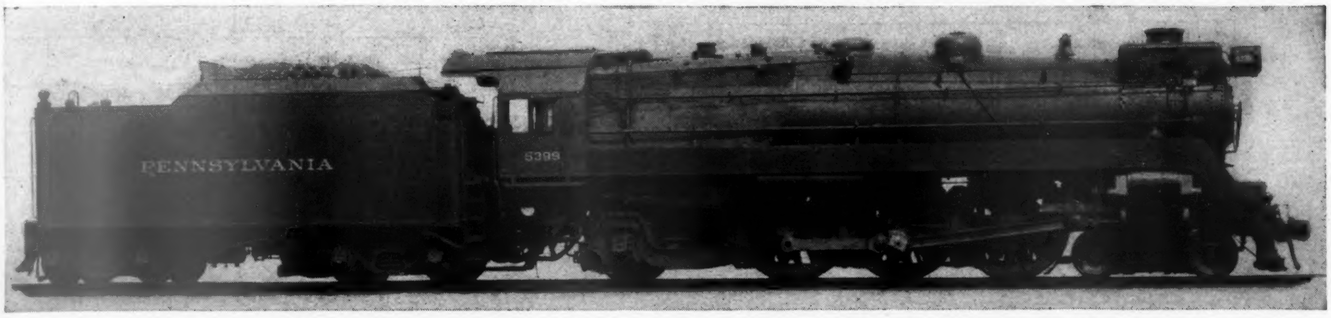


Locomotive No. 5399 after the installation of a new superheater header with the multiple throttle and type ASW single-pass superheater units

P. R. R. Locomotive with

Poppet Valves Tested at Altoona

Class K4s Pacific type No. 5399 subjected to an extensive series of plant tests in which it developed over 4,000 i.hp. at 100 m.p.h., an increase of over 40 per cent with a steam rate one third less than a piston-valve locomotive of the same class

In an extensive series of tests on the Pennsylvania Railroad test plant at Altoona, Pa., locomotive No. 5399, a Pennsylvania class K4s Pacific type equipped with the Franklin system of steam distribution, with O. C. poppet valves,* and a new single-pass Type ASW superheater, developed a maximum indicated horsepower of 4,267 at about 75 miles an hour and an indicated horsepower of 4,099 at 100 miles an hour. Compared with the indicated horsepower of a standard class K4s locomotive, at a steam consumption of 70,000 lb. per hour, No. 5399 showed an increase in indicated horsepower capacity of 16.2 per cent at 40 miles an hour, 17.1 per cent at 60 miles an hour, 22.9 per cent at 80 miles an hour, and 46.8 per cent at 100 miles an hour. Transposed into terms of steam economy, locomotive No. 5399 used 13.8 per cent less steam per indicated horsepower-hour at 40 miles an hour, 14.5 per cent less at 60 miles an hour, 18.4 per cent less at 80 miles an hour, and 31.7 per cent less at 100 miles an hour. While this improvement is largely due to the poppet valves, it should be stated that, in addition to the improved superheater, the No. 5399 was equipped with a larger dry pipe, front-end throttle, and larger steam pipes and exhaust passages, all of which contributed to the better performance. The highest net evaporation of locomotive No. 5399 was at 100 miles an hour, the highest speed tested, and amounted to over 77,000 lb. of water an hour.

The Test Program

Before the program of plant tests was started locomotive No. 5399 was taken into the shop for a new superheater. There was no change in the tube sheet or number of flues, but the original Type A superheater was removed and replaced with a new larger header, including the multiple throttle, and with single-pass Type ASW units, the pipes of which are bent in the form of a sine wave. Each unit consists of two loops in parallel, thus increasing the cross-sectional area of the steam

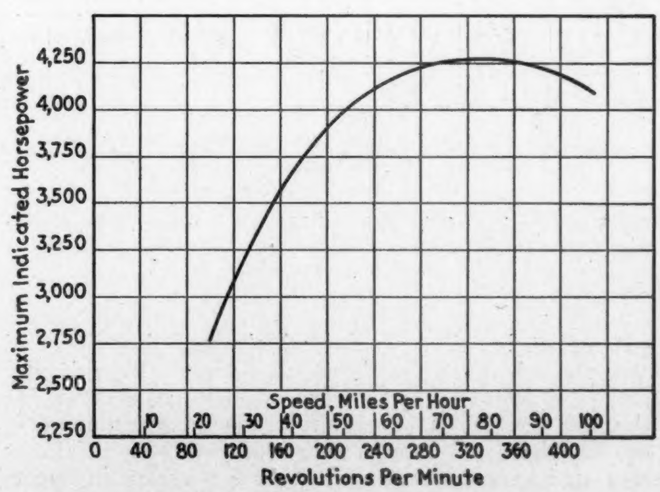


Fig. 1—The maximum indicated horsepower developed by locomotive No. 5399

* A description of the changes in this locomotive to fit it with the Franklin system of steam distribution and an account of the road tests and road service on the Pennsylvania Railroad appeared in the April *Railway Mechanical Engineer*, page 125.

passage through the units. Table I presents a comparison of the principal dimensions of the locomotive as it was tested on the road and as it was tested at Altoona. It will be seen that the area of steam passages has been increased so that the minimum restriction between the boiler and branch pipes has been increased from 45.5 sq. in., the area through the original superheater units,

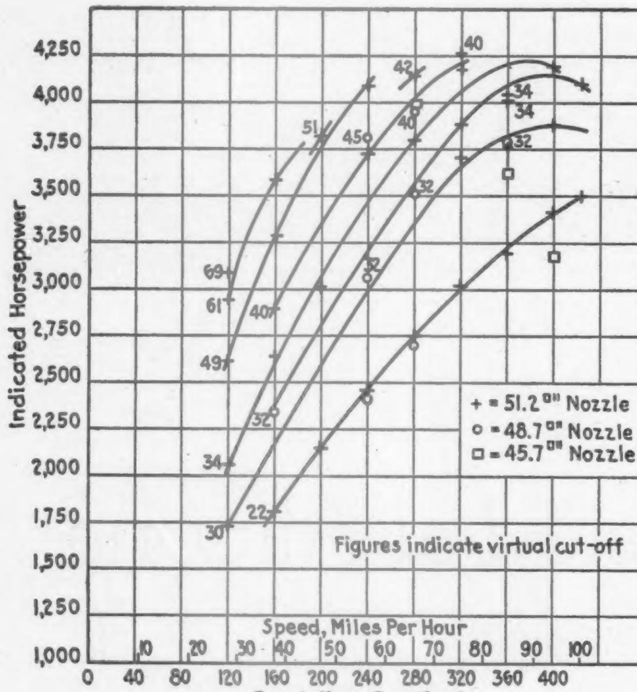


Fig. 2—The relationship of indicated horsepower to speed for various cut-offs of locomotive No. 5399

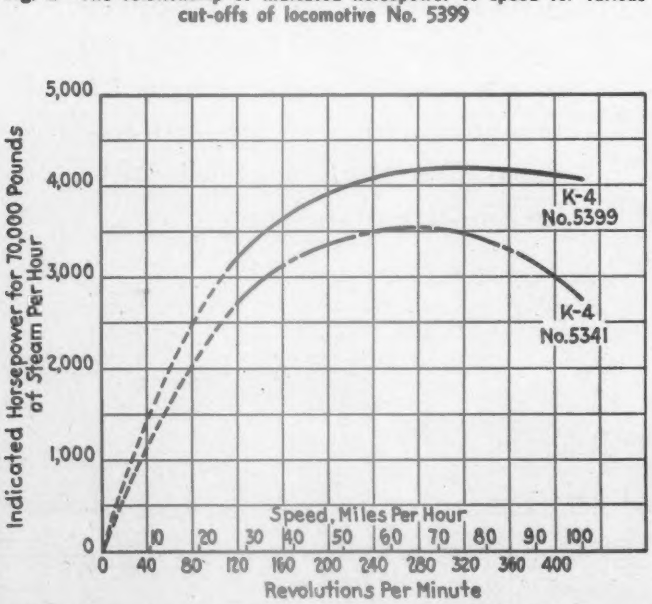


Fig. 3—Comparison of the indicated horsepower output of locomotives Nos. 5399 and 5341 for a uniform cylinder consumption of 70,000 lb. of steam per hour

to 70.9 sq. in., the area through the new dry pipe, and that the minimum area between the superheater header and each cylinder has been increased from 28.27 sq. in., the area through one superheater-header outlet, to 48.56 sq. in., the area through two intake valves. There is also an increase of approximately 6 per cent in superheater heating surface due to the lengthening of the units and the use of sine-waved unit pipes.

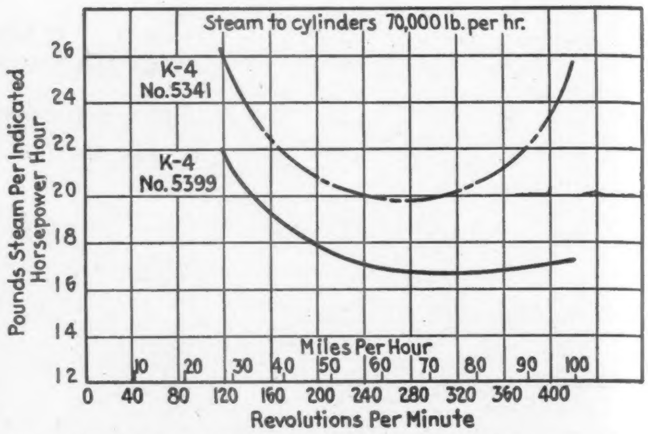


Fig. 4—Water rates of locomotives Nos. 5399 and 5341 for a uniform cylinder consumption of 70,000 lb. of steam per hour

The total engine weight of the standard K4s Pacific type locomotive is 320,000 lb. In Table I it will be seen that at the time of the road tests following the installation of the Franklin steam distribution system the weight was 330,800 lb. Following the installation of the new superheater and header the weight was 340,580 lb.

The test-plant program included a total of 56 test runs. These were divided in three series, each with a different size exhaust nozzle. The main series of 38 tests was run with a nozzle having a discharge area of 51.2 sq. in.; 15 tests were run with a 48.7-sq. in. nozzle, and three tests with a 45.7-sq. in. nozzle.

The best performance was obtained with a nozzle area of 51.2 sq. in., but the results with the 48.7-sq. in. nozzle were only slightly less favorable than those obtained with the larger nozzle.

The observations included all factors affecting boiler capacity and efficiency, cylinder performance, and machine efficiency. In this article for the most part consideration will be confined to those factors directly affecting evaporation and superheater performance, and cylinder and machine performance, all of which are affected by the steam-distribution system and the change in the superheater. The conditions under which the locomotive was tested in the main test series are set forth completely in Table II.

Table I—Dimensions and Weights of Pennsylvania Locomotive No. 5399

	At time of road test	At time of test-plant tests
Tractive force, lb.	44,460	44,460
Weight on drivers, lb.	208,800	216,930
Total weight, lb.	330,800	340,580
Driving wheels, diameter, in.	80	80
Cylinders, diameter and stroke, in.	27 x 28	27 x 28
Boiler pressure, lb.	205	205
Grate area, sq. ft.	68.7	68.7
Steam flow area, sq. in.:		
Max., through throttle	54.6	...
Through dry pipe	56.7	70.9
Through superheater subheaders	...	80.0
Through superheater units	45.5	...
Through double superheater units	...	91.0
Through multiple throttle	...	85.5
Through one header outlet	28.27	50.2
Through one steam pipe	50.2	50.2
Through two intake valves	48.56	48.56
Through steam port	54.0	54.0
Through two exhaust valves	68.0	68.0
Min., through one exhaust passage	68.0	68.0
Heating surfaces (fire side), sq. ft.:		
Firebox	311	311
Tubes and flues	3,375	3,375
Total evaporative	3,686	3,686
Superheater	1,205	1,277
Comb. evap. and superheater	4,891	4,963

Table II—Program of Tests of Locomotive No. 5399 Conducted at the Altoona, Pa., Test Plant

(Series with 51.2-Sq. In. Nozzles)

Nominal cut-off, per cent	Revolutions per minute								
	120	160	200	240	280	320	360	400	423
	(Figures in the columns below are the virtual cut-offs* at which the tests were actually run)								
15	8†	22	[2]22	22	22	[1]22	[4]22	[1]22	[3]22
20	30	..	..	..	..	30	30	30	30
30	..	..	..	..	[1]34	[2]39**	..	34**	[5]33
35	[1]34	[1]34	[1]34	[1]40	42	..	34**	..	..
40	..	40	..	..	..	..	..	..	..
45	49	49	49	..	..	..	..	..	..
50	..	..	..	[3]49	..	..	..	..	..
52½	..	..	51	..	..	..	..	..	..
55	61	61	..	..	..	..	..	..	..
68	69	..	..	..	..	..	..	..	..

[1] Lowest water rate at each speed (see Table III)
[2] Maximum db. hp. (see Table V)
[3] Maximum i. hp. (see Table V)
[4] Lowest water rate (see Table V)
[5] Maximum boiler output (see Table V)

* Virtual cut-offs are taken at 2-deg. camshaft swing before valve closure, corresponding to approximately $^1/_{64}$-in. valve opening.
† Obtained from indicator-card marking.
** Tests repeated.

Cylinder Power and Steam Rates

The principal results of the tests are presented in a series of graphs. Fig. 1 shows the maximum indicated horsepower characteristics of locomotive No. 5399. It is worthy of note that the curve is relatively flat over a considerable range of speed and that at 100 miles an hour the locomotive is still capable of developing more than 4,000 i. hp.

In Fig. 2 the indicated horsepower-speed relationships of the tests at the various cut-offs are shown and uniform cut-off lines have been laid in. These lines indicate the conditions at which the maximum indicated horsepower was attained at the various speeds.

Fig. 3 is a graphical comparison of the indicated horsepower performance of locomotive No. 5399 with that of another K4s locomotive, No. 5341, which was tested at Altoona in 1937. These curves are plotted for a uniform

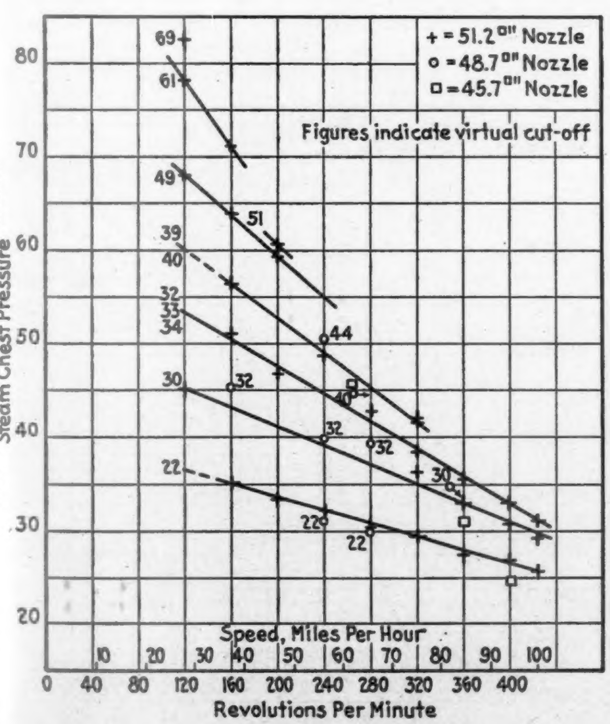


Fig. 5—How the ratio of mean effective pressure to steam-chest pressure varied with speed for each cut-off at which the locomotive was operated

cylinder steam consumption of 70,000 lb. per hour and, therefore, present an indication of relative economy as well as of indicated horsepower capacity. They show an increase in indicated horsepower in favor of locomotive No. 5399 of 16.2 per cent at 40 miles an hour, 17.1 per cent at 60 miles an hour, 22.9 per cent at 80 miles an hour, and 46.8 per cent at 100 miles an hour.

The economy aspect of the poppet-valve system of steam distribution is more clearly shown in Fig. 4 which compares the pounds of steam per indicated horsepower-hour at the 70,000-lb.-per-hour consumption rate for the

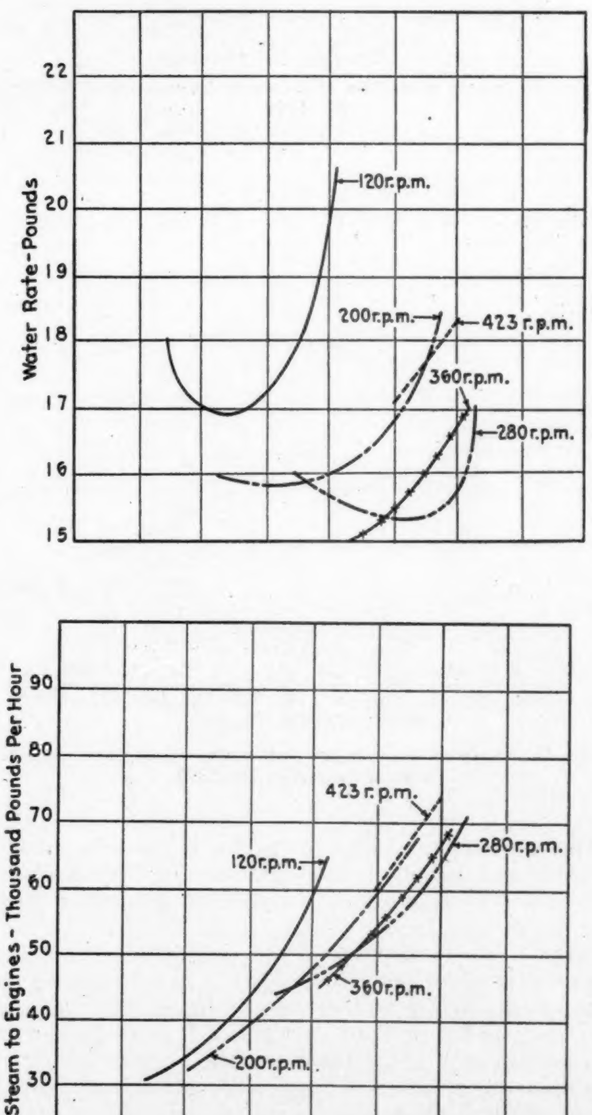


Fig. 6—Water rate and total steam-consumption curves for each of five selected speeds

two locomotives. The best economy of No. 5399 at this rate of steam consumption is 16.7 lb. per i. hp.-hr. at 75 miles an hour. In the case of locomotive No. 5341 the best steam rate at this rate of consumption is 19.8 lb. per i. hp.-hr. and was attained at about 65 miles an hour. At 85 miles an hour No. 5399 developed an indicated horsepower for 16.8 lb. of steam per hour, while the consumption for 5341 is 21.2 lb. per hour, and for higher speeds the difference increases rapidly.

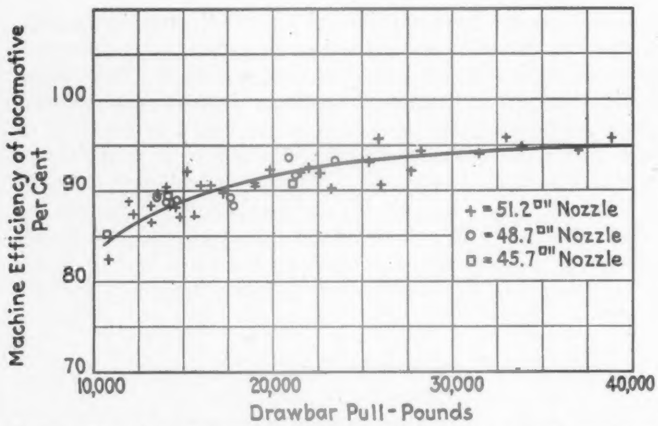


Fig. 7—The relation of machine efficiency to drawbar pull of locomotive No. 5399

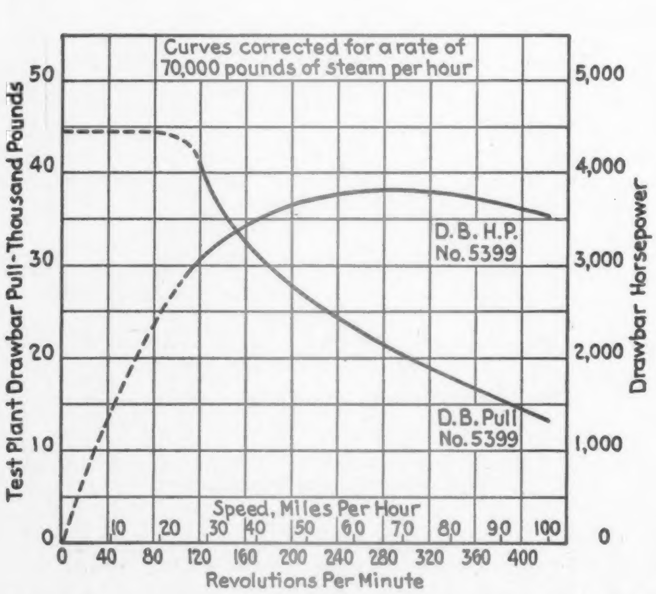


Fig. 8—The maximum drawbar-pull and drawbar-horsepower characteristics of locomotive No. 5399

The consistency of cylinder performance with changes in speed and cut-off is shown clearly in Fig. 5. Here the ratio of mean effective pressure to steam-chest pressure in per cent is plotted against the speed of the locomotive. The variations of the individual test values from the uniform cut-off lines are slight and a regular straight-line decline in the ratio of mean effective pressure to cylinder pressure is indicated as the speed increases. Like Fig. 2, this chart also indicates that the maximum mean effective pressure and indicated horsepower at the highest speed were attained with a cut-off of about 33 per cent. Shorter cut-offs will not develop the full capacity of this locomotive at speeds up to 100 miles an hour.

The trend of the relationship between total steam consumption and horsepower and the water rate and horsepower for various locomotive speeds are shown in Fig. 6. Tests were run at intervals of 40 r. p. m. Because of the relatively small spread of the values, however, clearness required the omission of curves for alternate values. Those plotted show speeds 80 r. p. m. apart, beginning with 120 r. p. m. It will be seen that for a given total steam consumption the horsepower increases with the speed up to 280 r. p. m. and then decreases for 360 r. p. m. and the maximum speed of 423 r. p. m. In the case of the water rate the minimum consumption decreases and occurs at progressively higher indicated

Table III—The Minimum Water Rate at Each Speed

(See also Table II)

Speed, r.p.m.	Virtual cut-off	Net water evaporated per hr., lb.	Steam to cylinders per hr., lb.	I. hp.	Water rate
120	34	35,760	34,790	2,063	16.9
160	34	43,304	42,318	2,640	16.0
200	22	35,274	34,265	2,146	16.0
	34	49,236	48,178	3,013	16.0
240	40	60,144	58,964	3,730	15.8
280	34	59,224	58,186	3,798	15.3
320	22	49,080	48,060	3,022	15.9
360	22	48,716	47,776	3,191	15.0
400	22	55,294	53,612	3,407	15.7
423	22	61,020	59,918	3,502	17.1

horsepowers for speeds up to 280 r. p. m. Above these speeds a given water rate is obtained at progressively lower horsepower outputs.

Supplementing Fig. 6, in Table III is shown the lowest water rate attained at each speed at which the locomotive was tested and the accompanying indicated horsepower. The pattern of the cut-offs for maximum economy is also shown in this table as well as in Table II.

The curves in Fig. 6, like Fig. 4, show that the range of best economy comes within the working range of speeds and horsepowers.

Drawbar Power and Machine Efficiency

The machine efficiency of the locomotive plotted against drawbar pull is shown in Fig. 7. From a value of 85 per cent at about 11,000 lb., the efficiency rises to a maximum of about 95 per cent at 40,000 lb. The median values shown by the curve have been applied to the indicated horsepower curve for 70,000 lb. of steam per hour to produce the values shown on Fig. 8, the drawbar horsepower curve.

One factor bearing upon the relatively high machine efficiency of locomotive No. 5399 is the small horsepower required to drive the valves and valve gear. No data segregating the power required for this purpose are available from the test-plant tests of the locomotive, but tests were made showing the power required to drive the gear box, cam box, and valves in the steam chests in the laboratory of the manufacturer. These values at various

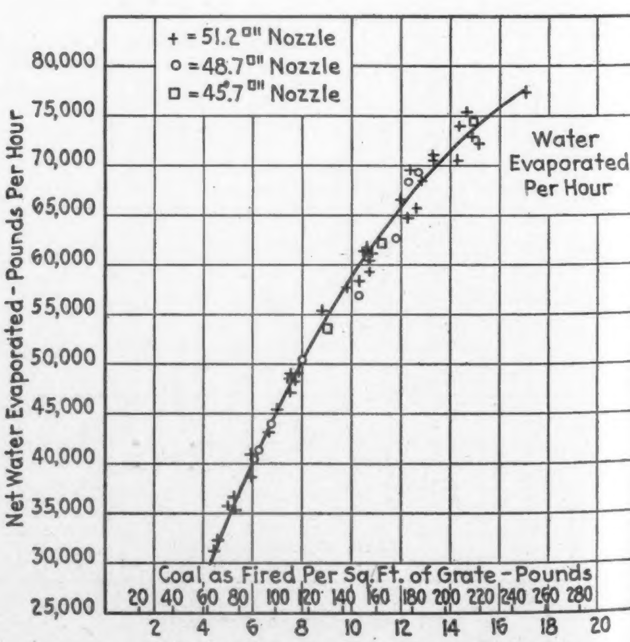


Fig. 9—The relation of net water evaporated to the coal fired for locomotive No. 5399

speeds are shown in Table IV. While the character of the drive between the gear box and the crosshead of the locomotive differs from that employed at the test plant, the figures indicate that an extremely small percentage of the friction horsepower of the locomotive is required to actuate the valves.

Boiler Performance

The performance of the boiler is shown in two charts. Fig. 9 shows the net water evaporated in pounds per hour in relation to coal consumption. It shows a maximum capacity of over 77,000 lb. with no indication of a marked change in the trend of the water-coal relationship at the higher boiler outputs. In Fig. 10 are shown the temperature of the steam at the steam chest and the degrees of superheat plotted against coal. In a number of individual tests within a range of coal consumption between 10,000 and 13,000 lb. per hour, steam temperatures slightly above 650 deg. were developed. These values range between a net water evaporation of about 58,000 lb. and 67,000 lb. per hour.

Selected Test Runs

The principal data from four tests are shown in Table V. These are the tests in which maximum indicated horsepower, maximum drawbar horsepower, maximum speed and boiler output, and maximum economy were attained. The maximum indicated horsepower was obtained at a speed of 75.8 miles an hour with a virtual cut-off of 39 per cent and a mean effective pressure of

Table IV—Horsepowers Required to Drive the Franklin Steam Distribution System

(Data from Tests in the Manufacturer's Laboratory)

R.p.m.	Horsepower
210	0.05
250	0.06
300	0.41
350	1.05
400	1.40
450	1.73
500	3.3

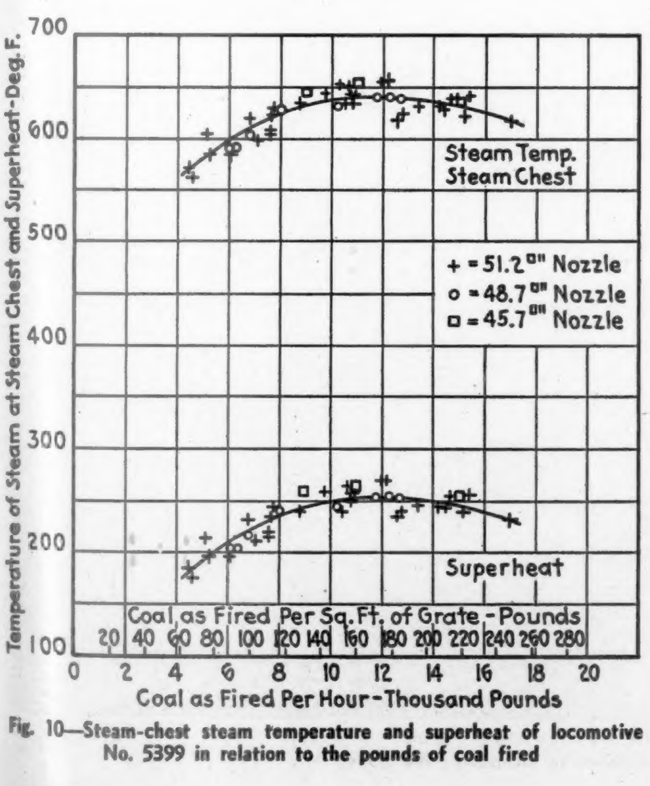


Fig. 10—Steam-chest steam temperature and superheat of locomotive No. 5399 in relation to the pounds of coal fired

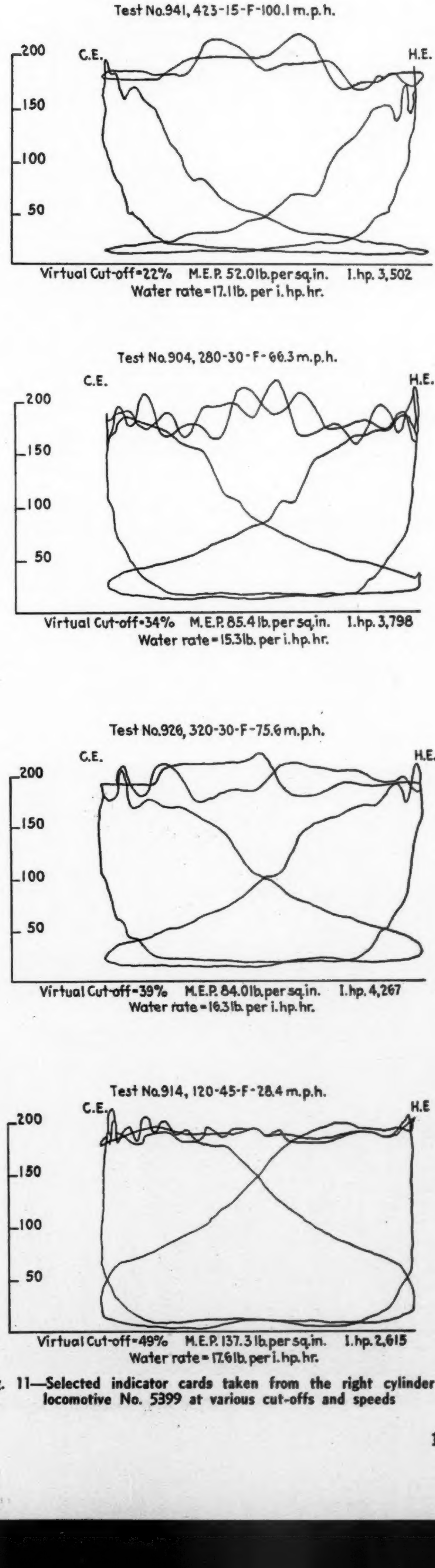


Fig. 11—Selected indicator cards taken from the right cylinder of locomotive No. 5399 at various cut-offs and speeds

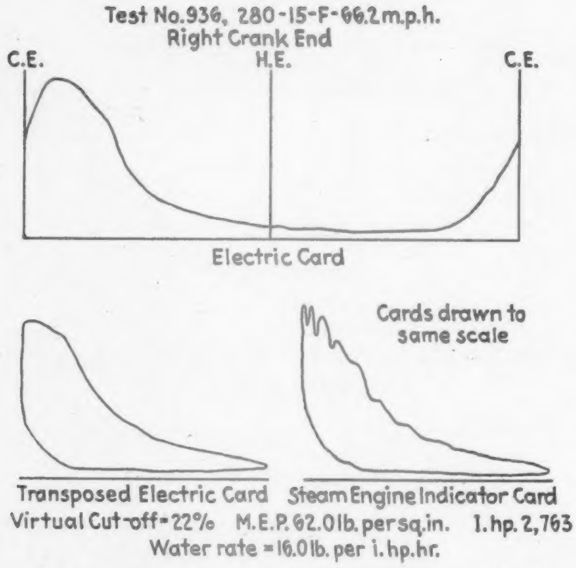
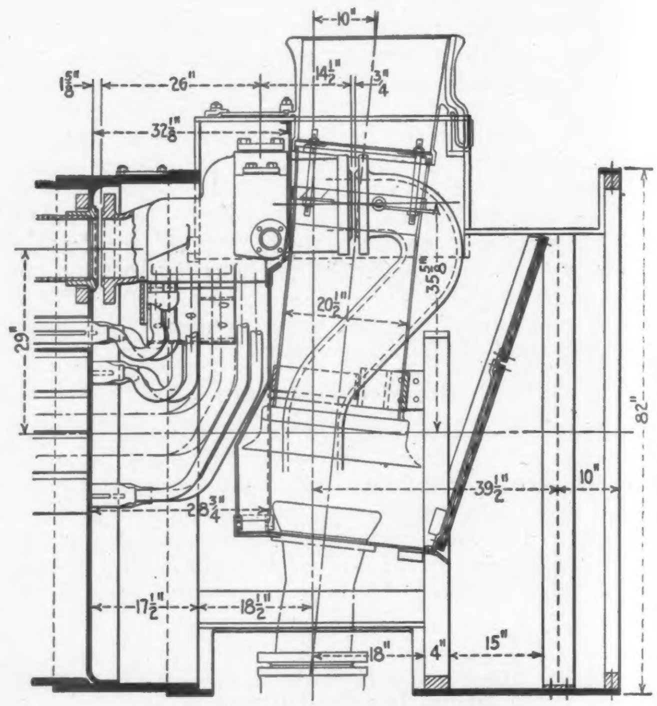


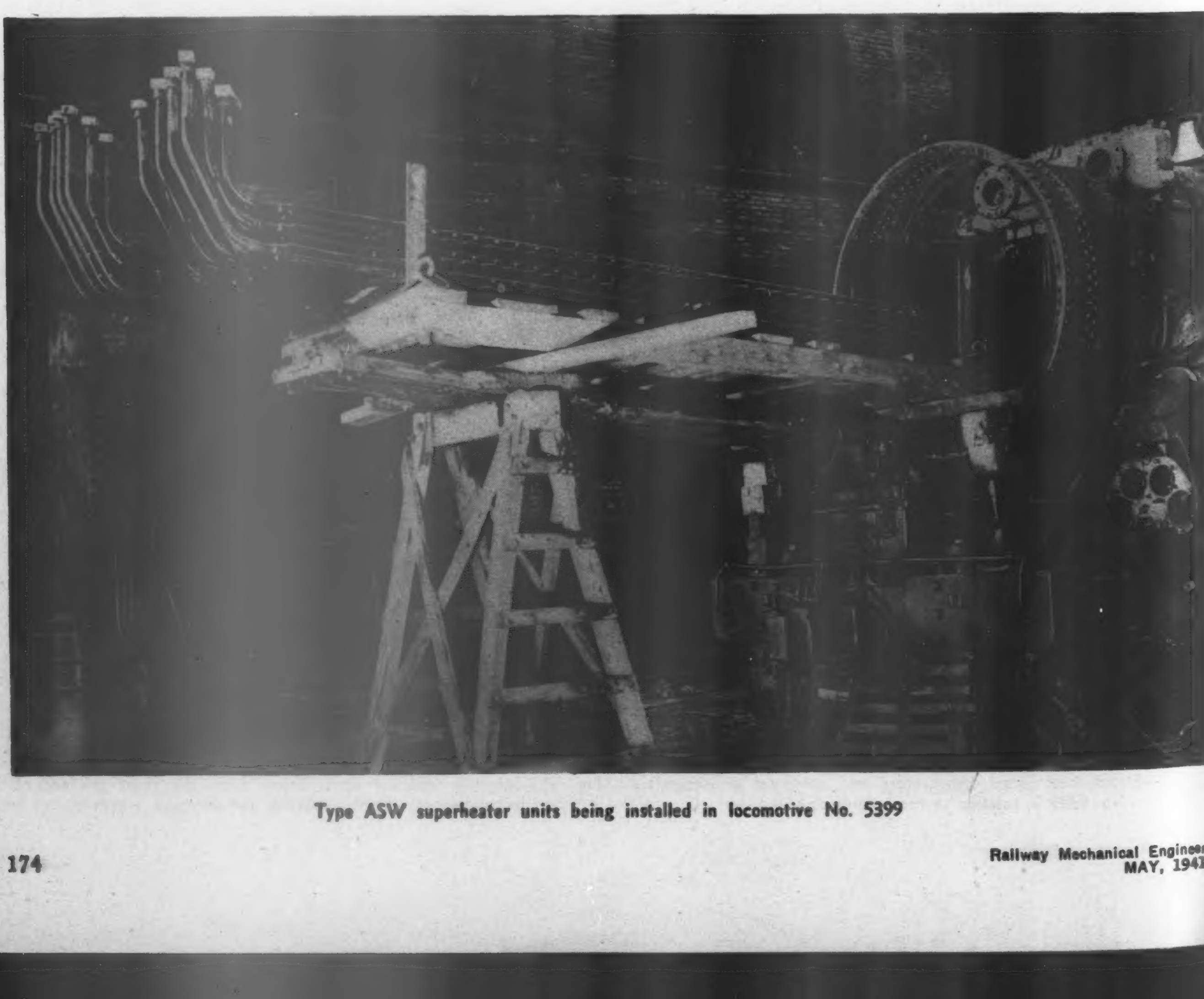
Fig. 12—How the electric indicator card compares with the cards taken from the steam-engine indicator

84 lb. per sq. in. The indicated horsepower was 4,267 which was developed with a consumption of steam at the cylinders of 69,430 lb. per hour and a net water evaporation of 70,585 lb. of water per hour. The maximum drawbar horsepower of 3,934 was developed at 56.8 miles an hour with a virtual cut-off of 49 per cent. The machine efficiency in this test was 95.6 per cent. Several other tests equalled or slightly exceed this one in machine efficiency, but 1,188 lb. of friction drawbar pull was the lowest recorded in any of the tests.

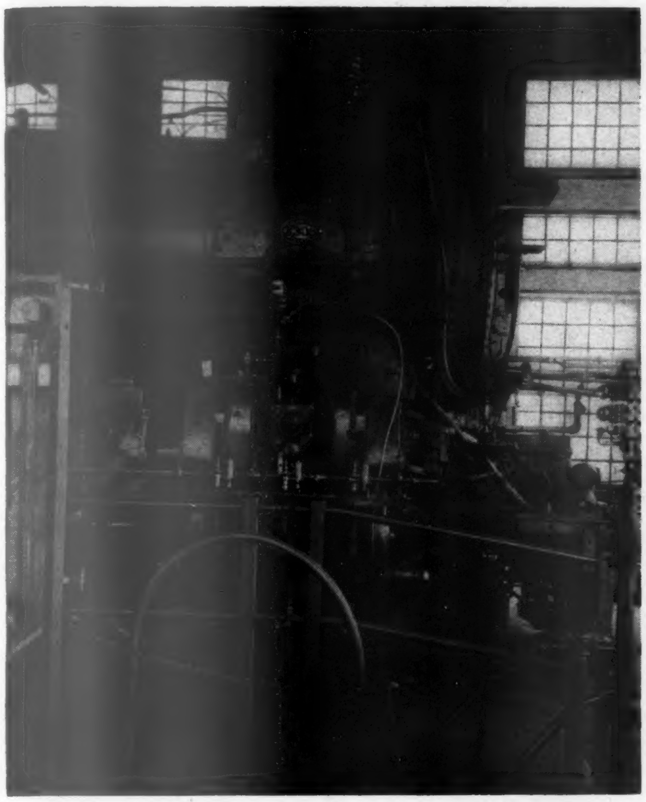
The maximum boiler output was obtained at 100 miles an hour and 33 per cent cut-off. In this test the net evaporation was at the rate of 77,480 lb. of water per hour, of which 76,208 lb. passed through the cylinders, developing 4,099 i. hp. Maximum economy was obtained in a test at 85.2 miles an hour with a virtual cut-off of 22 per cent and a net evaporation of 48,715 lb. of



How the front-end was arranged to accommodate the type ASW superheater on locomotive No. 5399



Type ASW superheater units being installed in locomotive No. 5399



Locomotive No. 5399 in the Pennsylvania railroad test plant at Altoona

Table V—Data from Selected Tests of Pennsylvania Locomotive No. 5399 with Franklin Steam Distribution System and Type ASW Single-Pass Superheater

(51.2 Sq. In. Exhaust Nozzles)

Test number	926	903	927	938
Selected because of	Max. i. hp.	Max. db. hp.	Max. speed; max. boiler output	Max. economy
Designation—r.p.m., cut-off, throttle	320-30-F.	240-50-F.	423-30-F.	360-15-F.
Virtual cut-off, per cent	39	49	33	22
Duration, hrs.	0.2	0.5	0.5	0.5
Speed, m.p.h.	75.8	56.8	100.0	85.2
Temperature, deg. F., steam in steam pipes to locomotive cylinders	632	639	617	608
Boiler pressure, lb.	205	204	203	205
Pressure drop between boiler and steam chest (total), lb. per sq. in.	10.5	9.6	10.8	7.7
Superheat, deg. F., steam in steam pipes to locomotive cylinders	246	254	233	221
Superheat, deg. F., exhaust steam from locomotive cylinders in exhaust passages	45	52	54	8
Net water evaporated, lb. per hr.	70,585	75,250	77,480	48,716
Equiv. evaporation, lb. per hr.	94,985	101,244	103,790	64,945
Equiv. evaporation, lb. per hr. per sq. ft. heat. surface	19.1	20.4	20.9	13.1
Superheated steam, lb. per hr.	69,430	73,934	76,208	47,776
Mean effective pressure, lb. per sq. in.	84	107.9	61	56
Indicated horsepower, total	4,267	4,114	4,099	3,191
Water rate, steam per i. hp.-hr., lb.	16.3	17.97	18.6	15.0
Drawbar horsepower, total	3,862	3,934	3,547	2,790
Drawbar pull, lb.	19,110	25,961	13,301	12,282
Water rate, steam per db. hp.-hr., lb.	18.3	19.1	21.8	17.5
Tractive force based on mean effective pressure, lb.	21,122	27,152	15,373	14,048
Locomotive friction, hp.	405	180	552	401
Locomotive friction, pull at drawbar, lb.	2,004	1,188	2,070	1,765
Machine efficiency, per cent	90.5	95.6	86.5	87.4
Steam per i. hp.-hr., lb. (calculated from heat drop in cylinders)	17.1	17.1	18.6	15.7
Difference between steam per i. hp.-hr. from heat drop and from indicator cards as a percentage of water rate, steam per i. hp.-hr.	+4.9	−4.8	0.0	+4.7
I. hp. calculated from heat drop in locomotive cylinders	4,060	4,324	4,099	3,043

water an hour. The locomotive developed 3,191 i. hp. with a cylinder consumption of 15 lb. of steam per horsepower-hour.

A selection of indicator cards representing several speeds and cut-offs are reproduced in Fig. 11. The best single indication of the effect of the characteristics of the poppet valve (i. e., quick opening and closing with a high percentage of full port areas between these events) is shown by the card selected from test No. 941 at 100.1 miles an hour and 22 per cent virtual cut-off. This card developed a mean effective pressure of 52 lb. per sq. in. and the indicated horsepower was 3,502.

Indicated horsepower calculations were made from the conventional steam-engine indicator cards. A qualitative comparison of these cards with those taken at the same time with electric indicators is shown in Fig. 12. The electric indicator, the measuring element of which is a diaphragm free from the effect of inertia forces, produces a smooth card with the events clearly defined. These cards are considered conclusive evidence that the irregularities of the cards from the conventional indicator are caused by conditions inherent in the indicator itself and do not reflect pressure irregularities in the locomotive cylinder.

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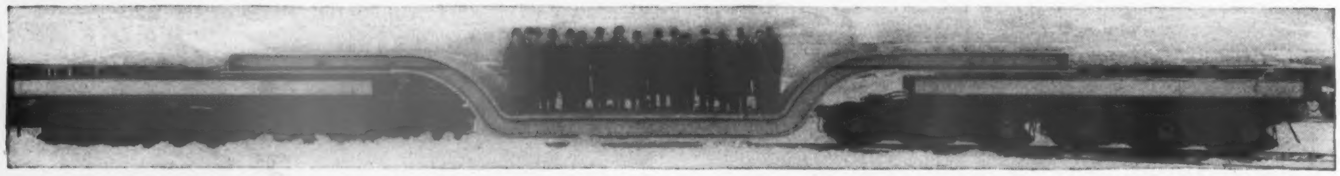
The City of Midland, flagship of the Pere Marquette's car-ferry fleet, made its first trip March 12 between Ludington, Mich., and Milwaukee, Wis.



A 250-ton well car built for the Carnegie-Illinois Steel Corporation by the Greenville Steel Car Company

A Welded

High-Capacity Well Car

The well body consists of seven heavy H-beams, the flanges of which are arc welded together—The ends and well portion of each beam are rolled-sections; the curved transition pieces, fabricated sections, all joined by Thermit welding—The well body is carried on four six-wheel trucks

A WELL car, 90 ft. long over the coupler pulling faces with a load capacity of over 250 tons, has been built for the Carnegie-Illinois Steel Corporation by the Greenville Steel Car Company. The car is for use in carrying ingot molds between two Carnegie-Illinois plants and is completely fitted for regular interchange movements. Aside from its great size and high load-carrying capacity, the car is unusual in that the completely welded body involved the use of Thermit welding as well as arc welding in its fabrication and because the load is carried on four six-wheel trucks, two under each end.

The car consists of two auxiliary bodies on the center sills of each of which are center plates which rest on two of the six-wheel trucks and in one end of each of which is mounted the coupler and draft gear. The inner end of each auxiliary body terminates at the bolster. The well body is carried on the two auxiliary bodies through large center plates.

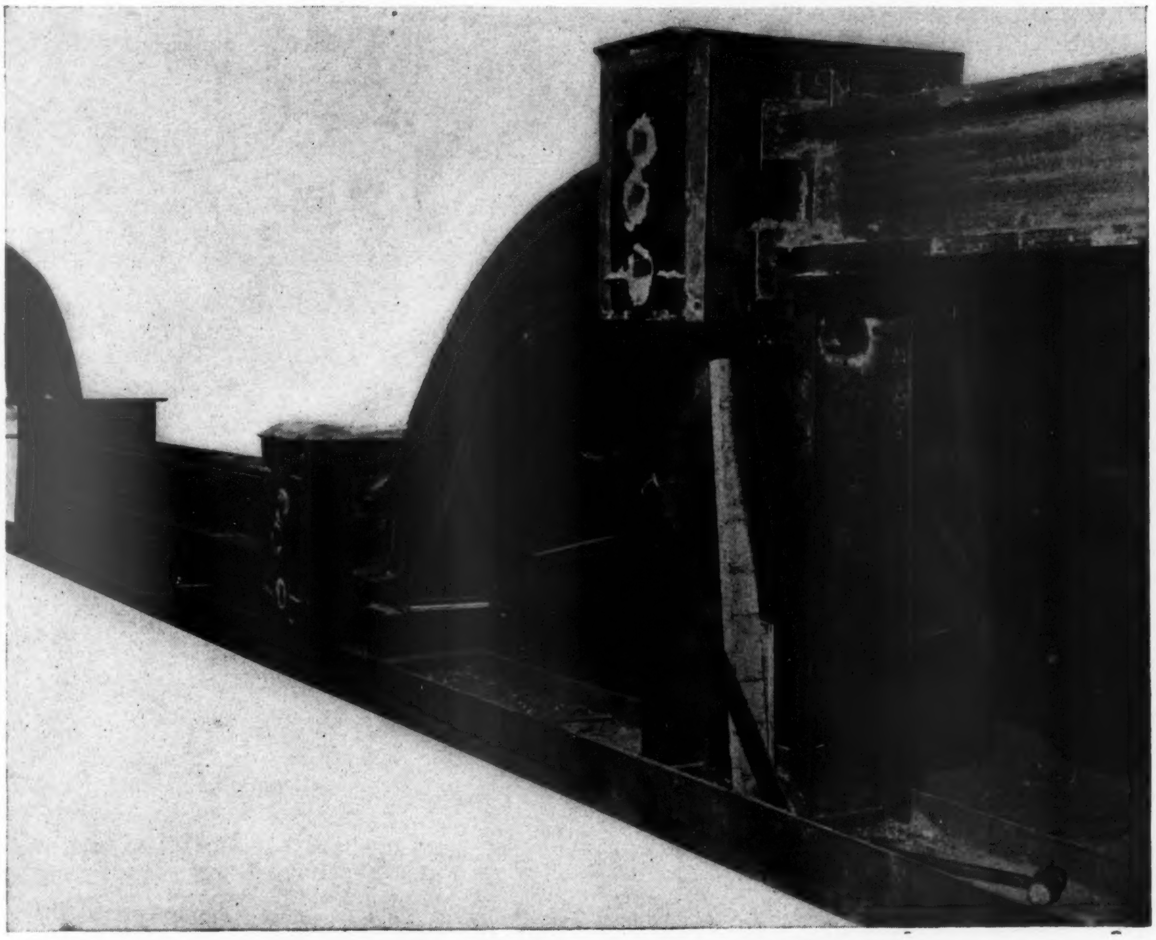
The trucks are the Buckeye six-wheel type with 36-in. rolled-steel wheels mounted on axles with 7-in. by 14-in. journals. The wheel base of each truck is 10 ft. The truck castings are of Grade B steel.

The brakes consist of two sets of AB equipment with special features, furnished by the Westinghouse Air Brake Company, and eight 10-in. by 8-in. brake cylinders, one on each side of each of the four trucks. On each auxiliary body is mounted the standard AB valve with its double compartment reservoir, a relay valve, and a separate auxiliary reservoir. The AB valve directly controls the pressure in two of the brake cylinders and this, in turn, operates the relay valve which serves to develop a corresponding pressure in the other two from the separate auxiliary reservoir. Each cylinder actuates the clasp brake rigging for its set of three wheels. Flexible armored hose is used in the brake-pipe line between the well body and the auxiliary bodies and in all the brake-cylinder pipe connections. There is a hand brake on each end of the car and each hand brake operates the brakes on the two six-wheel trucks applied under that end of the car.

The total weight of the car is 313,900 lb., of which 107,920 lb. is in the four trucks, 49,000 lb. in the two auxiliary bodies, and 156,980 lb. in the well body proper. The pay-load capacity at a rail load limit of 70,000 lb. per axle is 526,100 lb.

The car body is fabricated by arc welding, together, longitudinally, seven long H-beams. Each H-beam, in

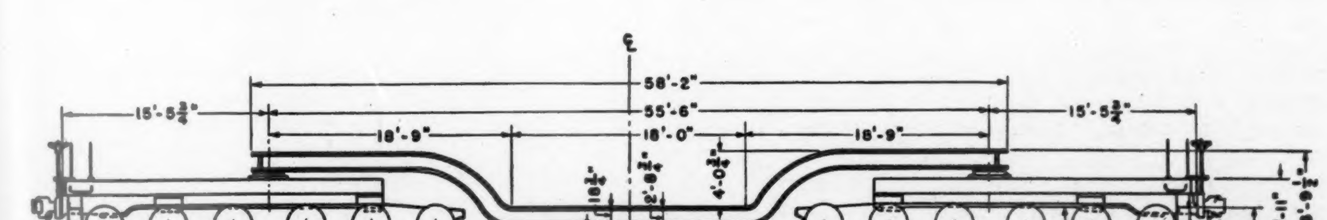
One of the Buckeye six-wheel trucks—The wrought-steel wheels are 36 in. in diameter

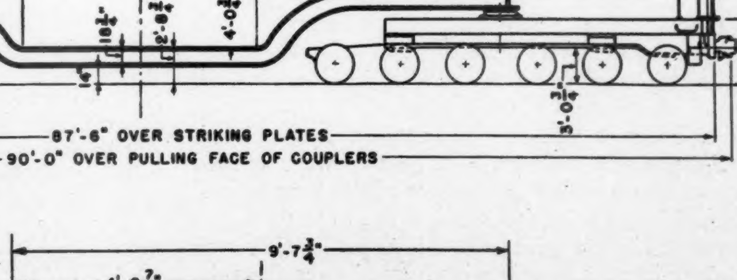


The parts of one of the well-platform beams set up for Thermit welding

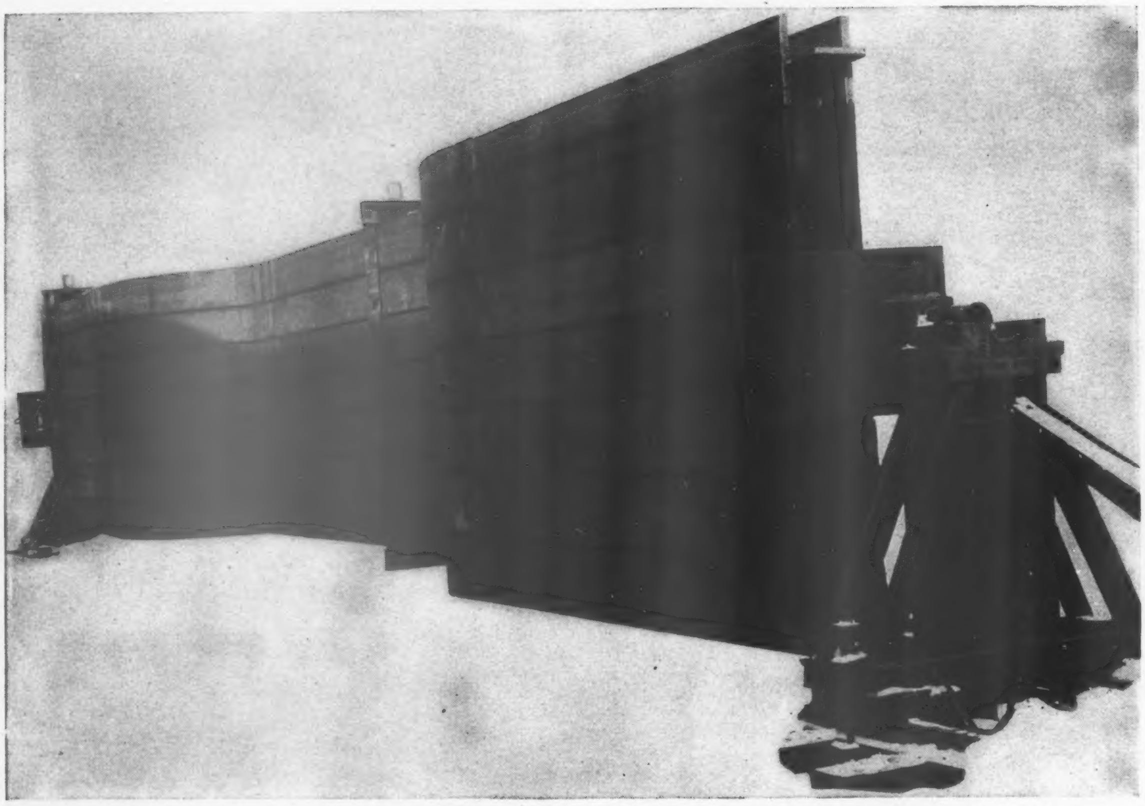
turn, was made up of five separate pieces butt welded together by the Thermit process. These members comprise the central platform piece, two reverse-curve transition pieces, and two end pieces which terminate at the main bolsters. The two beams on the outside of the load-carrying platform are rolled steel, weighing 426 lb. per ft., and the five internal beams of the platform are rolled steel, weighing 370 lb. per ft. The pieces are of rolled sections, weighing 264 lb. per ft.

The curved transition pieces are fabricated beams 16 in. wide and tapering from 18¾ in. high at the bottom to 16½ in. high at the top. They are made up of 1¾-in. web pieces and 3-in. flange pieces. Web plates were flame cut to the required reverse curve and chamfered





General dimensions of the well car and cross-section at the transverse center line showing the location of the arc welds by which the separate beams are joined to form the platform



The well platform assembled in the arc-welding jig—The Thermit weld collars on the beams are clearly shown

on each side to a depth of ¾ in. Top and bottom flanges were first machined with J-grooves at the edges for welding the beams together when complete, then bent to shape. The parts of each beam were assembled in a jig and the flanges were welded to the web in eight alternate passes on each side of the web. Three-quarter-inch fillets were then built up on top of these welds in six passes on each side. Following completion of the transition pieces, the succeeding step was the Thermit welding of the seven long beams for the body of the car. Because 28 welds, all alike, were to be made, patterns for forming molds could be used advantageously and the work could be set up on a production basis. Beams were fabricated in pairs. On the first day, for example, one beam was lined up in a jig and the four molds applied. Next day the welds on this beam were preheated, two at a time, and poured. At the same time, while preheating of the welds on the first beam was in progress, a second beam was lined up. On the third day molds were applied to the second beam, and on the fourth day these beams were heated and poured. When the welding of each pair of beams was completed, the work was interrupted until the welded beams could be removed and another pair set in place.

With the Thermit welding of the beams completed, seven diaphragm stiffeners on 3-ft. centers were welded into the channels on each side of three of the long beams. The two end bolster beams were then welded to the center beam at right angles and this sub-assembly was bolted in place in a positioning jig located over the rails where final assembly of the car was to be completed. This jig was equipped with trunions to permit revolving the assembly for compensation of warping and to enable all welds to be made downhand.

With the center beam and end bolster assembly in the jig, the remaining beams were dropped in place as required and each one welded in position. Continuous longitudinal welds the entire length of the platform and transition portions of the long beams were employed in welding the body of the car together. For this welding J-grooves 1⅝-in. deep and ¾ in. wide at the top had been machined before assembly in the outside edges of the center beam and the two beams next to the outside.

Warping was kept to a minimum by close control of heating the assembly during welding and by careful welding procedure. The entire assembly was maintained at about 200 deg. F. throughout the welding operation. The heating system devised, however, included a means of raising and lowering the temperature at various points, together with gages distributed at several places over the assembly to enable welding contractions to be measured and offset. Sufficient control was obtained in this manner so that the entire assembly could be raised or lowered a full inch by varying the temperature of the upper or lower flanges. Welding was started with 12 operators working in 10-hr. shifts and continued without interruption until the work was finished. With two operators working on each of the six seams, welding proceeded on one side of the car until the gages showed that the car body had been pulled ½ in. out of line. The whole assembly was then turned and welded on the opposite side until the body had been moved ½ in. out of line in the other direction. On an average, at the outset the work required turning twice in a 10-hr. shift; later this was increased to once in 10 hrs.

Although all of the welded steel was a copper-nickel alloy, mild steel welding electrodes were employed for the greatest part of the work.

Upon completion of the welding on the long beams and the end bolsters, the positioning fixtures were removed temporarily to permit inserting the end sills and then replaced so that the welding in of the end sills and body side bearings could be positioned. The jigs were then removed permanently and the center plates riveted and welded in place.

Automatic Spot-Welding in

Freight-Car Construction*

By John W. Sheffer†

Combined with arc-welding of roof and side-frame members, and riveting to join the roof, side, end, and underframe sub-assemblies on the track production line

WELDED construction of cars is not new, but it has had a slow growth. Our company built four welded tank cars back in 1908. These cars were gas welded and for welding electrodes we used scrap trimmings from the plate material used in the construction of the shell and heads. They were for Peru, S. A., and to the best of our knowledge have given satisfactory service.

At the South St. Louis plant in 1911 the American Car and Foundry Company built the first spot-welded freight car, with welding equipment of their own manufacture. A few rivets were used in the car, but only for the purpose of holding the erected members in place during the spot-welding operation. This method of holding the parts was used instead of jigs on account of the savings in cost, as but one car was built. This car was C. B. & Q. No. 71699 and had an official inspection with report in 1925. This report indicated the spot welding stood up to full expectation.

Over 25 years ago, to meet special applications, the company designed and manufactured more than 15 spot welders, several of which were portable. These were the first applications and use of portables. There were no such welders on the market.

During the twenties, welding became more and more extensively used, but it was still confined to car parts and miscellaneous products. Some of the welded items were at the junctions of window stooling, deck sills, and plates, door sills and headers, partitions, etc. The fusing of wire nails to the inside of sheathing to form fasteners for the application of insulation was one of the early applications of butt welding.

During the early thirties this builder made five 50-ton gondola cars for the Chesapeake & Ohio. These cars were equipped with one-piece cast-steel underframes. Floors and the superstructures were of welded construction. Later in the same year, a similar car was built, but with a structural-steel riveted underframe, the floors and superstructure being assembled by arc welding. These cars were placed in heavy service, were carefully watched, and the latest reports are very favorable toward arc welding.

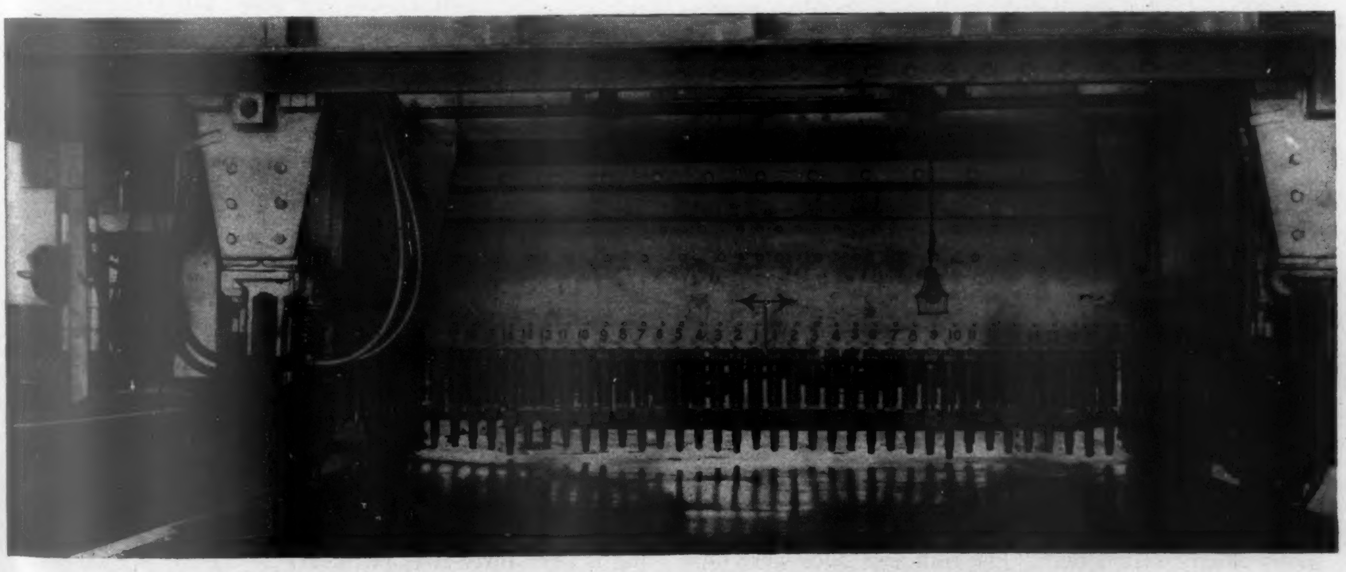
Automatic Arc Welding

Since 1932, the American Car and Foundry Company has been building covered hopper cars for various commodities such as cement, carbon black, as well as other dry commodities. Without welding, it would have been impossible to have attained the smooth interior necessary for the discharge of the lading. At the present time, these covered hoppers are manufactured in quantities in which the whole car body, except the trucks, is welded. There is approximately 1,100 ft. of arc welding on this covered hopper body. One quarter of this is on the hopper sides and may be done automatically in sub-assemblies.

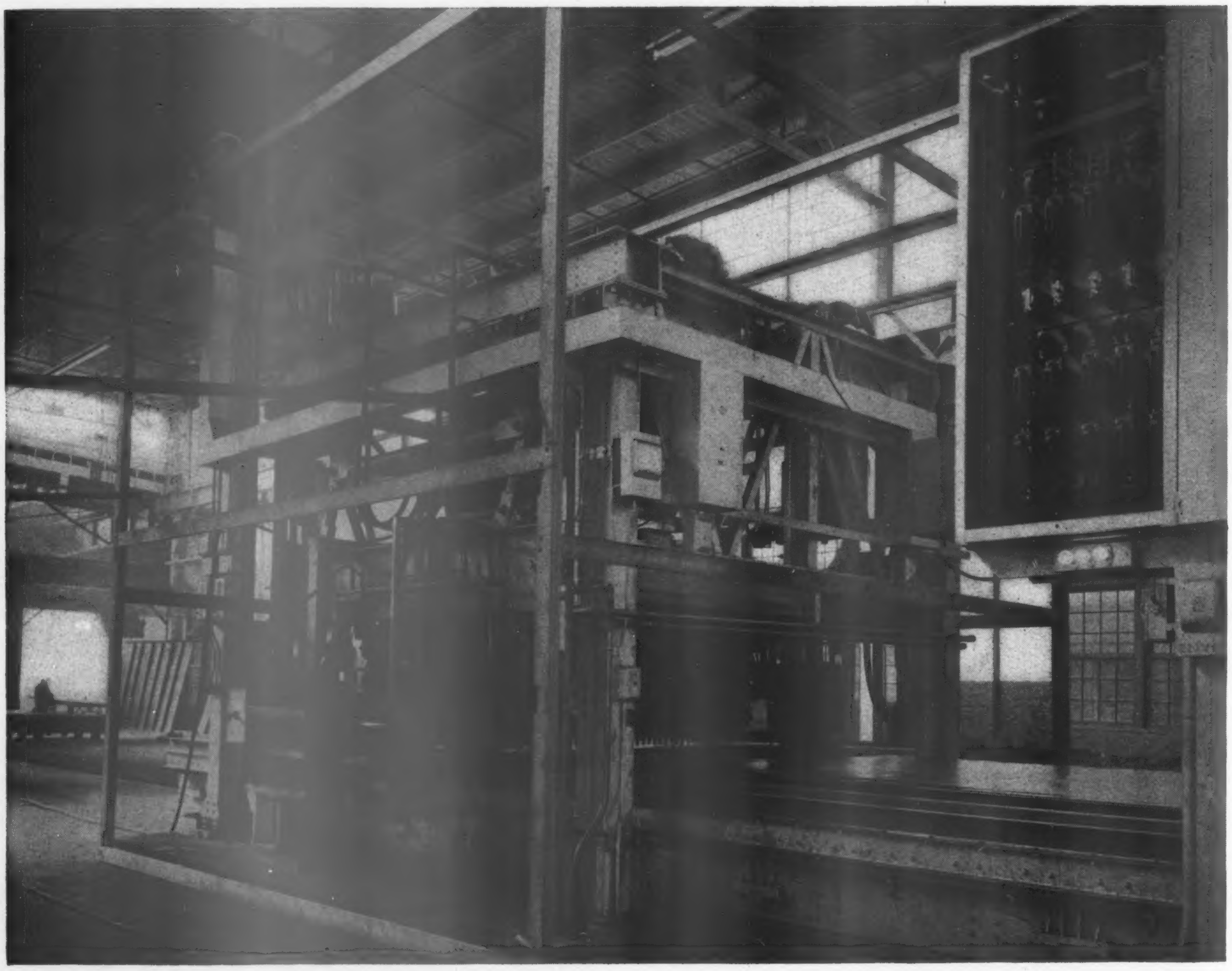
The use of automatic arc welding arises from the desire to obtain greater economy in labor and material, more uniform results, greater operating factor, higher welding currents which in turn measure greater production, and reduced fatigue on the operator. Automatic

* Abstract of a paper presented before the St. Louis, Mo., Section of the American Welding Society, April 11, 1941.

† Electrical engineer, American Car and Foundry Company.



The platen and electrodes of the car-side welding machine



Automatic spot welder which joins the sheathing to a box-car side frame in a single operation for each panel—The indexing of the jig car under the platen and the cycle of welding operations are performed by the operator at the left through push-button controls

arc welding is particularly adapted to high production welding where there are a large number of similar operations or where there is enough footage of the same type of welding to justify it, in which case a fairly expensive holding or clamping fixture can be justified.

Two of our shops manufacturing hopper cars are equipped with thyratron control, automatic arc-welding equipment, using the lightly coated coiled electrode. This is a special application on the welding of hopper-car side stakes to the sheets which act as stiffener members to those sheets and become integral with the car side-frame work.

Evolution of Automatic Spot Welding

In 1934, this builder designed spot-welded passenger cars of high-tensile low-alloy steel in which the exteriors of the cars were perfectly smooth. Two trains of these cars were delivered in 1935 and a third train in 1937. These trains were complete with Diesel-electric power cars. I refer to the Rebel trains running on the Gulf, Mobile & Northern between New Orleans, La., and Jackson, Tenn.

I direct this construction to your attention because it is a step in the development of spot welding on a production basis. We call it the panel-section type of spot-welded construction. The roof and sides were built up to 9-ft. 6-in. sections and assembled on the car by means of rivets through the vertical flanges of the side-post angles.

A specially built vertical-gap spot welder was located in a pit at the final spot-welding position, for attaching the side sheathing to the side sills. In these cars the underframe was completely riveted. Thus, we have passenger cars with a riveted underframe, separate panels for sides and roof of spot-welded construction, and final assembly of the three sub-assemblies by spot and arc welding and riveting.

As is usually the case, after the cars were delivered the next step was a study of improvements in production to determine what could be done to reduce the cost. This study developed many interesting things, but two predominant factors stood out as high lights to be followed in increasing production. First, if feasible, spot weld a complete side and complete roof with a machine capable of making welds both simultaneously and consecutively. Second, assemble these units finally into a complete shell by concealed rivets.

Production Welding of Freight Cars

During the year 1940, at our Madison, Ill., plant, equipment was installed and 400 lightweight box cars were produced of welded construction. The weight saving is over three tons per year.

Arc welding in the assembly of the A. A. R. Z-type

Electrode set-up for welding a roof panel in one operation

center sill, specially designed for welding, is now universally used in freight-car construction. In fact, owing to the wide variations in the thickness of the sections used for the various members in the car underframe, arc welding became the preferred method of assembly. However, accurate preparation is most important, so that excess weld metal is not required. There is but one seam that may be welded automatically; the others are too short to justify a set-up.

The various members of the underframe, such as bolsters, cross bearers and cross ties, are first fitted up and arc welded in sub-assembly jigs. The main assembly must have an accurate, sturdy jig which firmly holds the various parts to be assembled in their proper places, so they may be properly arc welded into one rigid unit. When production quantities permit, a rotating or positioning jig is provided. The freight-car ends are made up of several pressings arc welded together along their horizontal adjacent edges.

The unit system of fabricating underframe, sides, roofs and ends of freight cars by welding in jigs apart from the main track assembly permits positioning for horizontal arc welding when required and accessibility for more careful work and inspection. The final assembly by rivets of these main sub-assemblies in track production lines facilitates the desired output and secures economies in repairs at some future date.

The Automatic Spot Welder for Car Sides and Roofs

In fabricating the roofs and side units, spot welding is performed by special multiple spot-welding machines. This development in multiple spot-welding equipment, through the use of a multiple distributing switch in the secondary or heat-generating circuit, permits the entire group of electrodes to be put under pressure simultaneously. These electrodes act as a self-contained clamp at each and every weld location. They remain in that position through the entire cycle of individual electrode welding sequence. The facilities for applying the correct

Freight-car side-frame welding jig—An assembled side is shown in the jig car at the left

amount of pressure on all electrodes simultaneously and having them dwell until the various welds are sufficiently cool produce a clean, strong and uniform weld.

A multiple spot welder is made up of the following principal functions:

1—A constant-pressure hydraulic system for platen lift and electrode shift.
2—An adjustable-pressure hydraulic system, as supply to all electrode cylinders.
3—Multiple mounted transformer units as supply to multiple electrode groups.
4—Primary current supply to each transformer group through ignitron contactor and mechanical timing cams.
5—High-speed secondary distributing switches.
6—An indexing welding jig car covered with a secondary copper grillage.
7—A water-cooling system to transformer, secondary switches, distributing cable and electrodes.

These automatic multiple welding machines consist of an upper moving platen, upon which is mounted the multiple electrode set-up. One machine is used for car roofs and a second for car sides.

The panel welder for roofs has two welding jig cars which move on a track under the electrode platen and permit a continuous operation of the welder, roof after roof. The alternate jig car is loaded with a roof frame and roof sheets by the fitters and moves into the welder as soon as the other jig car vacates the welding position.

Preliminary to the spot-welding operations the roof framing and side-framing members are assembled in accurate jigs and firmly clamped into position. In the case of the roof, the carlines are arc-welded to the side plate and the purlins to the carlines. In the case of the side-framing members the posts are arc welded to the side-sill angle and the side plate.

The framing unit is then placed on the secondary copper grillage of the welding jig car which backs up the multiple electrodes. The sheets are fitted and clamped in position for spot welding. The motor-driven jig car through its push-button magnetic control is indexed to the panel to be spot welded.

The platen, with a set-up of the required number of electrodes, is lowered to contact the work through a push-button magnetic control valve from the constant-pressure hydraulic system. At the same time, the contact shoes at the direct welding transformers make contact with the copper bus-bar grillage at each side of the welding jig car. All the electrode cylinders are put under pressure simultaneously through manually operated valves and supply from the adjustable-pressure hydraulic system.

The motor-driven secondary distributing switches pass about twenty thousand amperes to each welding electrode connected to respective segments of the switches. These switches are started by push button and stopped by a limit switch at the end of their travel and are operated both forward and backward.

These secondary switches are operated simultaneously on three-phase closed-delta primary power supply with three welding transformers and three ignitron contactors available to supply current to the bus-bar power distribution. In this manner a panel of 70 to 80 spot welds may be divided and made in one-half the time. Two of these secondary switches are operated consecutively to segregate a group of about 32 spots in sequence of 19 and 13 spots respectively. No. 3 secondary switch is operated two welds at a time as in series spot welding. Adjustable timing cams operate the micro switch attached to the trolley of each secondary distributing switch and determine the desired timing of each spot.

Intermediate spacing of spots requires a 1-in. lift of the platen and a 1-in. and 2-in. shift of the electrode mounting and shifting slide. The panel cycle is then repeated as required to meet the spacing required. When the panel cycle is completed, the platen is raised 4 in. and the jig car is indexed to the next panel.

More than a dozen push buttons and more than a dozen manual valves are assembled on a central operator's control board. Manually, these individual controls initiate any one of a dozen operations. The manual setting of a selector switch, however, will automatically execute a dozen operations as one. Duplicate panels may thus be spot welded with dispatch.

Magnetic control through a sequence panel is the brain or nerve center making possible the several functions in the execution of a panel cycle. The push buttons, selector switch, limit switches, contactors, and solenoids are interconnected with the entire machine set-up to obtain the following functions:

1—Permit manual control of each welding operation individually if desired.
2—Permit a set-up to be made which will then proceed automatically to the final pre-set point.
3—Permit any previously pre-set set-up to be interrupted if desired, a single operation performed and then continue the set-up.
4—Manual termination of any individual operation.

The set-up for panel welding of car roofs of a given design utilizes three transformers, five secondary switches, and 86 electrodes arranged in five groups—two groups of 19 electrodes each take the cross-line or carline welds; two groups of 13 electrodes each at right angles take the sideplate welds; a fifth group of 12 electrodes, also at right angle to the first two groups, takes the purline welds between the carlines.

These 76 electrodes are attached to the spot-welder platen through pedestal mountings and shifting slides which permit 76 or 152 additional spot welds to be made by a 1-in. vertical lift of the platen and a 1-in. and 2-in. lateral movement of the various groups of electrodes, parallel to the mountings of the electrode groups.

The welding operations are electrically controlled to provide maximum speed and efficiency with a minimum of attention from the operator. The control provides and involves sequence of electrical interlocks between various parts of the machine. This interlock acts to start and terminate the movement of all associate machine parts in the proper order and to prevent the movement of any part of the machine when such movement would cause injury to the machine or materials being welded. In addition to regulating the mechanical motions of the machines, the control also serves to set up the proper circuit for welding and also times the application of welding current for each spot weld.

This equipment, through limit switches, relays and multi-point selector switch, provides automatic functioning on all operations as they are required.

The recent installation of multiple spot-welding equipment at our St. Charles, Mo., plant is adapted for the welding of passenger-car sides and roofs of alloy steel. The panel welding of passenger-car sides and roofs is accomplished on a single welder with certain changes, however, in the electrode set-up. A single welding jig car for sides and another for roofs is required. The set-up of electrodes for both the passenger-car sides and roof on the panel welder depends on the design, but is similar in all respects to the set-up for freight-car sides previously described.

Yard employees working on the night shift at the Canadian National's Leaside car shops, Toronto, Ont., put their training as fire fighters to good use recently, according to a Canadian National weekly news letter. Laying six lines of hose to avert fire threat from near-by oil and gasoline storage facilities and using a yard locomotive as a pumper, the employees worked side by side with Toronto city firemen in bringing the flames under control.

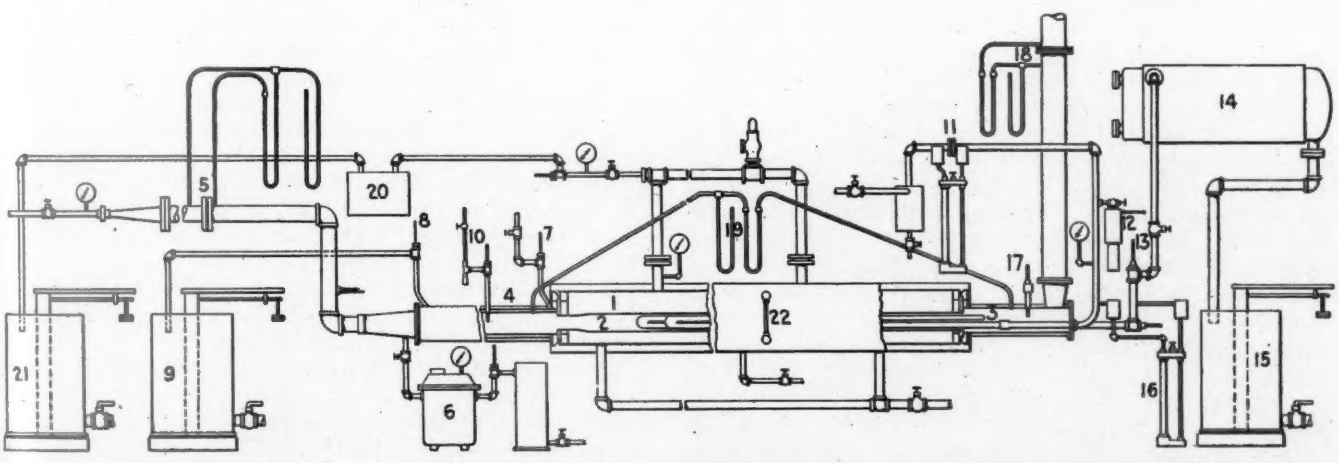
Superheater Research*

By Arthur Williams†

An account of a 10-year laboratory study of more than forty designs of units undertaken to improve the performance of locomotives built with Type A Superheaters—units of two designs now in locomotive service

The superheater is one of the most important parts of the steam locomotive. The superheater design determines the heating surface and gas area of the boiler barrel. These in turn influence the evaporation obtainable from the boiler and the efficiency of heat absorption. For a given boiler pressure, the steam pressure at the cylinders depends upon the pressure drop through the superheater units and header, and the temperature of the steam is the result of the heat absorbed by the superheater. These two factors, the steam temperature and pressure at the cylinders, control the steam rate or cylinder efficiency. From these considerations it is clear that the over-all performance of the steam locomotive is very closely controlled by the superheater design.

The first practical superheater to be used in this country was of the design known as the Type A which is still in use on a great number of locomotives. With the increase in power and evaporation of the locomotive it was necessary to change the superheater design so that increased superheat could be obtained to give maximum cylinder efficiency and at the same time accommodate the increased steam flow through the superheater resulting from high rates of evaporation. The result was the Type E superheater, which still remains the best superheater design. Compared to the boiler and superheater with the Type A design, there is from 8 to 10 per cent increase in the total flue evaporative heating surface for the same length of flues, with 3 to 6 per cent increase in the gas area through the boiler and 35 to 50 per cent increase in superheater heating surface. At the same time it is possible to obtain an increase in steam area through the superheater. These factors give increased boiler efficiency, increase in maximum evaporation and higher superheat.



1—Boiler
2—Flue
3—Superheater unit
4—Water-cooled furnace
5—Air-flow meter
6—Fuel-gas meter
7—Furnace cooling-water temperature—Inlet
8—Furnace cooling-water temperature—Outlet
9—Furnace cooling-water weighing tank
10—Furnace gas temperature thermocouple
11—Steam flow meter
12—Calorimeter
13—Final steam temperature thermometer
14—Condenser for steam through unit
15—Weighing tank for steam through unit
16—Steam pressure drop manometer
17—Exit flue gas thermocouple
18—Flue gas flow meter
19—Draft manometers
20—Evaporated steam condenser
21—Evaporated steam weighing tank
22—Boiler gage glass

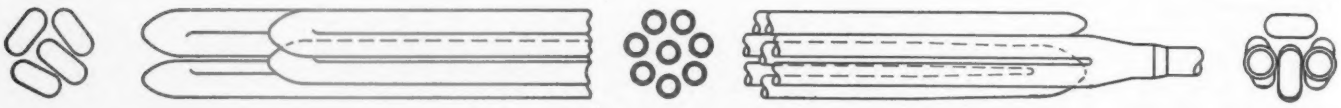
Fig. 1—General arrangement of test apparatus

Improving the Type A for Existing Locomotives

While the Type E superheater represents the best locomotive superheater design, The Superheater Company recognized that there were a great number of locomotives equipped with Type A superheaters in 5½-in. and 5⅜-in. flues. In 1930 a research program was started to study superheater design for use with these large flues. It was desired to find a unit which would be interchangeable with the Type A, would have approximately the same draft loss so that no changes in drafting would be necessary in an existing engine, and would give increased superheat, improvement in heat absorption efficiency of the flue and unit and the same or less pressure drop through the unit. Such a unit could be applied to existing locomotives with a minimum

* A paper presented before the Metropolitan Section, American Society of Mechanical Engineers, on February 26.

† Manager Production Engineering Department, The Superheater Company, East Chicago, Ind.



Unit No. 1

Fig. 2

of expense and would give either decrease in fuel consumption or increase in power. From the practical standpoint the unit had to be sufficiently flexible in structure so that no trouble would be encountered with warping or with leaking header joints, and easy to keep clean from cinders and slag.

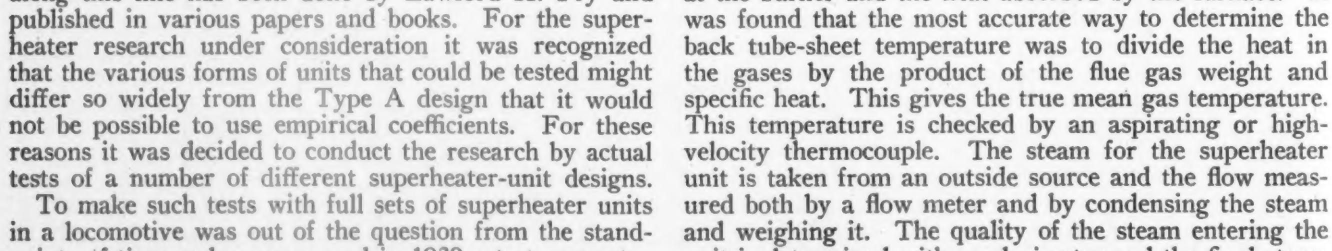
In determining the course which such research should take, attention was first given to existing data on the heat transfer from hot gases to a colder metal surface. Considerable work has been done on this subject and it is possible to calculate the film coefficient with fair accuracy. This coefficient depends upon the viscosity, conductivity, density and velocity of the gas in question, and the physical dimensions of the flue or tube in which the gas is flowing. The film coefficient will be in terms of B. t. u. per sq. ft. per hr. per deg. F. temperature difference, which gives the heat that will be transferred for each square foot of heating surface and for each degree difference in temperature between the mean gas temperature and the metal temperature.

It is this last item, the temperature difference, which makes the exact calculation of heat transfer for a locomotive flue and superheater unit extremely difficult. The gas temperature is rapidly changing along the flue and in the case of a Type A unit heat is being transferred simultaneously to five surfaces, all of which are at different temperatures. For a given superheater design, it is possible to use formulas with coefficients that have been determined by experiment. Considerable work along this line has been done by Lawford H. Fry and published in various papers and books. For the superheater research under consideration it was recognized that the various forms of units that could be tested might differ so widely from the Type A design that it would not be possible to use empirical coefficients. For these reasons it was decided to conduct the research by actual tests of a number of different superheater-unit designs.

To make such tests with full sets of superheater units in a locomotive was out of the question from the standpoints of time and expense, and in 1930 a test apparatus was built which could test one superheater unit at a time, under operating conditions similar to those obtained in road service, with exact control of all the factors involved. On a locomotive, the results obtained from the superheater depend upon the weight of products of combustion flowing through the superheater flues, the temperature of the products of combustion at the back tube sheet and the steam flow through each unit. The quality of the steam entering the superheater influences the final steam temperature but for purposes of comparison it can be assumed that the steam will be dry. A number of road tests were analyzed, and curves were drawn representing the relation between weight of gas flow, temperature at the back tube sheet and steam flow through the unit. From these curves sufficient settings were decided upon to give a picture of the superheater-unit performance over a wide range of capacity. By adjusting the three controlling factors in accordance with the actual road operation, it was felt that the results obtained in the test apparatus could be expected to be the same in road service. Subsequent tests confirmed this reasoning.

The Test Apparatus

The test apparatus is shown in Fig. 1. The boiler is 16 in. in diameter and 20 ft. long with one 5½-in. flue. A water-cooled furnace is fired with gas. Both the fuel gas and air for combustion are measured with flow meters. The sum of the two gives the total weight of products of combustion. The heat absorbed by the water-cooled furnace is calculated from the weight of water flowing and the temperature rise. The heat at the back tube sheet is the difference between the heat at the burner and the heat absorbed by the furnace. It was found that the most accurate way to determine the back tube-sheet temperature was to divide the heat in the gases by the product of the flue gas weight and specific heat. This gives the true mean gas temperature. This temperature is checked by an aspirating or high-velocity thermocouple. The steam for the superheater unit is taken from an outside source and the flow measured both by a flow meter and by condensing the steam and weighing it. The quality of the steam entering the unit is determined with a calorimeter and the final steam temperature with a thermometer which is checked by a thermocouple. The steam pressure drop through the unit is measured with a mercury manometer to obtain the greatest possible accuracy. The steam evaporated



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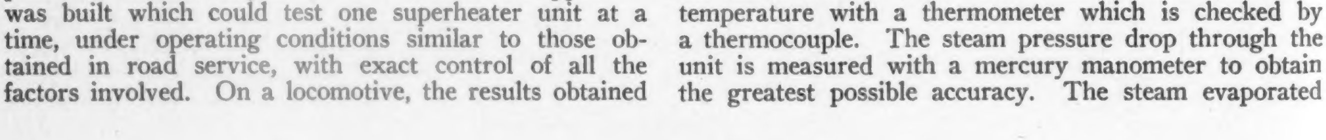
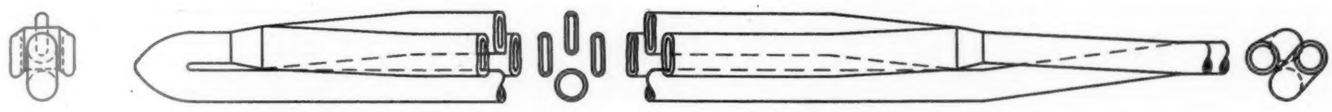
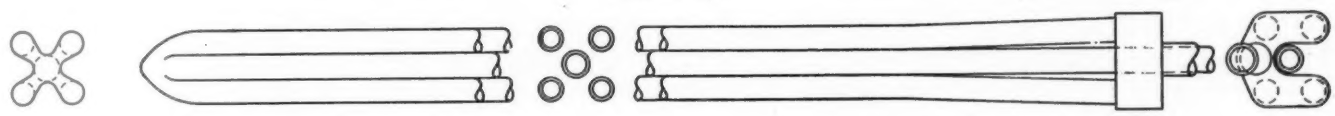


Unit No. 2-B

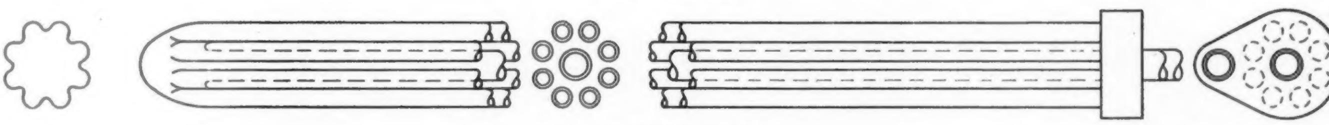
Fig. 3



Unit No. 3-A



Unit No. 3-B



Unit No. 3-C

Fig. 4

by the flue is collected in vertical risers, condensed and weighed. The temperature of the gases leaving the flue is measured with a thermocouple and the draft loss through the flue with a water manometer.

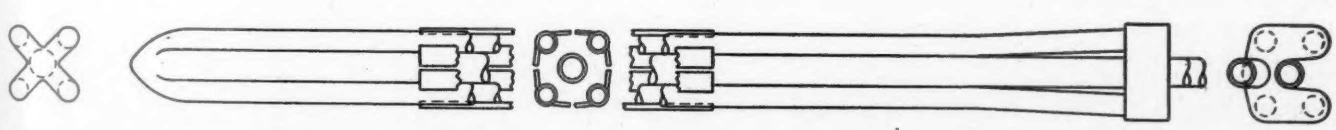
For given conditions of flue-gas flow, back tube-sheet temperature and steam flow through the unit, observations are made of the final steam temperature, temperature of the gases leaving the flue, draft loss, evaporation from the flue and steam-pressure drop through the unit. To eliminate all possible errors each unit is compared with a standard Type A unit. The Type A unit is first tested at the standard settings. The experimental unit is then tested and finally the Type A unit is put in the apparatus again for a final check to be sure that all parts of the test apparatus are functioning properly.

Test Units Divided in Five Groups

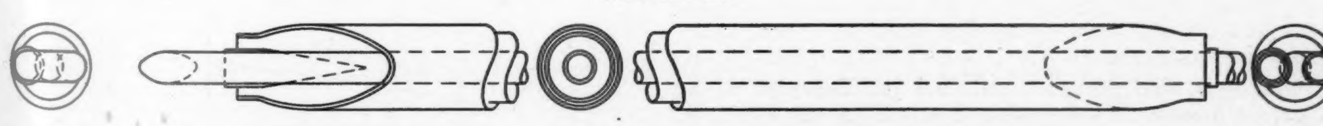
To date, 43 different designs of superheater units have been tested. The majority of this work was done in 1930 and 1931, although tests have been conducted up to date and the test apparatus is now a permanent part of The Superheater Company's facilities at East Chicago for further development of superheater design. To give a picture of the work done without going into detail for each one of the 43 designs, 13 of the units tested will be discussed, since they show various aspects of this research. These units are shown in Figs. 2 to 6, and can be divided into five groups. One of the first attempts to obtain increased superheat was to use a larger number of smaller pipes so that increased superheater heating surface was obtained with approximately the same gas area. This group is represented by Fig. 2, unit No. 1. A fair increase in superheat was obtained but the increased friction surface gave a decided increase in draft loss. If this unit were applied in a locomotive boiler the increased resistance to gas flow would cause a greater proportion of gas to flow through the small tubes and the increase in superheat desired would not be obtained.

In the second group, Fig. 3, units numbers 2-A and 2-B represent designs which give increased turbulence on both the outside and inside of the unit. Unit No. 2-A gave an increase in superheat that was offset by the increase in draft loss due to turbulence on the gas side. Unit No. 2-B was designed with a greater gas area so that the draft loss was satisfactory, but the superheat obtained was slightly less than for the Type A. In general, it can be stated that for a given draft loss or pressure drop the best heat transfer is obtained with plain tubing.

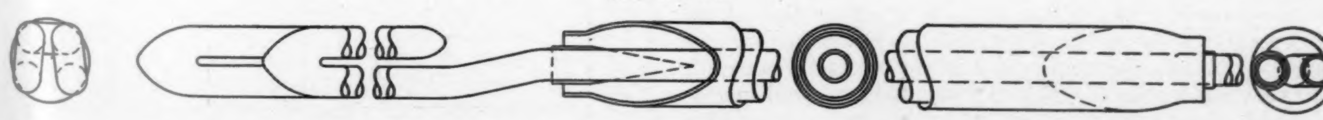
To obtain the maximum heat transfer for a given heating surface between a hot substance and a cold one it is usual to arrange the flows so that the two substances flow in opposite directions, giving counterflow. It is not practical to have 100 per cent counterflow in a locomotive superheater since the steam enters the superheater from the front end and also returns there. It is possible to have all of the heating surfaces in counterflow except for the return pipe and the third group of units, Fig. 4, shows three different designs which do this. Unit 3-A gave approximately the same superheat as the Type A with a decrease in draft loss. It seemed from this that it should be possible to increase the heating surface of the unit and so obtain the same draft loss with an



Unit No. 4-A



Unit No. 4-B



Unit No. 4-C

Fig. 5

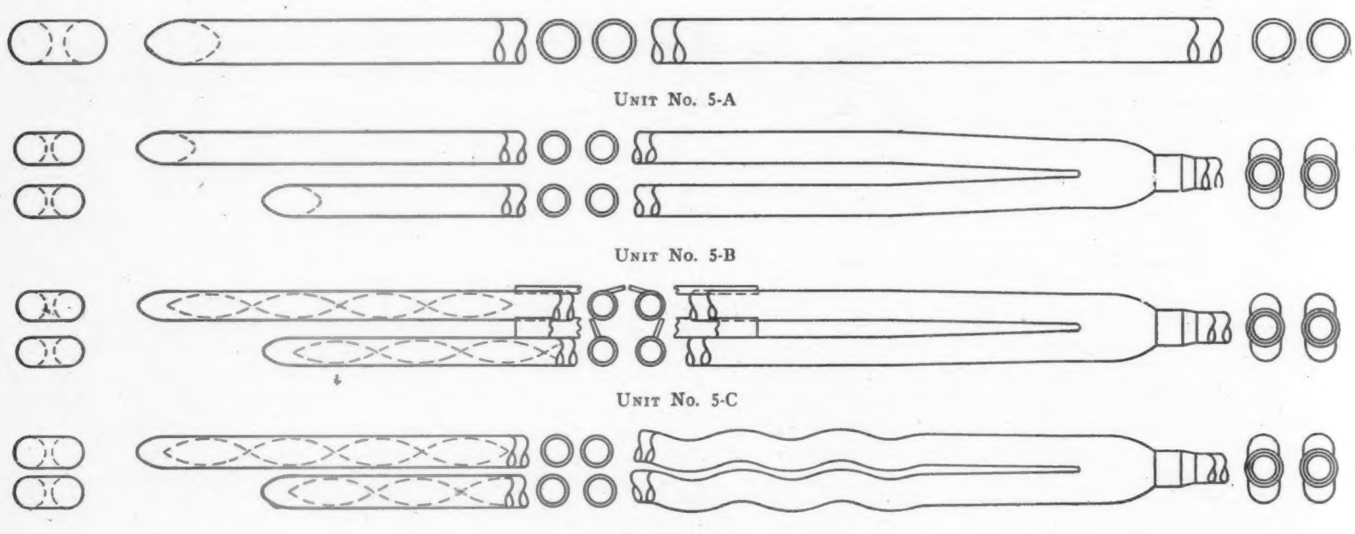


Fig. 6

increase in superheat. Unit 3-B was designed with this in mind but it was found that with the same draft loss as the Type A unit there was no appreciable increase in superheat. Unit 3-C went still further in this direction and a good increase in superheat was obtained but the increase in draft loss was sufficient to offset the increase in superheat.

The results obtained with these three units differed considerably from what would be expected with a counterflow arrangement. This was probably due to the complicated heat transfer conditions which occur in a locomotive flue. The counterflow arrangement of heating surface decreases the mean temperature on the steam side and increases the mean temperature on the gas side. The increase of the mean temperature of the flue gas increases the heat transfer to the flue. The result appears to be a slight increase in evaporation and efficiency of heat absorption but the desired increase in superheat is not obtained.

The fourth group of units, Fig. 5, includes three designs in which the relative amount of heat transferred to the flue and to the superheater unit is controlled. Unit No. 4-A had the same arrangement of pipes as unit No. 3-B. Somewhat smaller pipes were used for the counterflow surface and fins were welded on in such a way that the gas flow along the flue was divided into two parts. The gas flowing between the flue and the outside of the superheater unit could transmit heat to both, but the gas flowing along the inside of the unit could transmit heat only to the unit. As far as draft loss was concerned, the increased friction surface was compensated for by an increase in gas area, so that the draft loss obtained was the same as for the Type A. Approximately 50 deg. increase in superheat was obtained for the same conditions with a decrease in the temperature of the gases leaving the flue. This unit was very satisfactory in the test apparatus and was later tested in road service.

Unit 4-B also gave a controlled gas flow but in a different manner. The counterflow surface consisted of two pipes with the steam flowing in the annular space between them. The return was by a single pipe along the center of the unit. This unit gave satisfactory results as far as superheat and draft loss were concerned, but it was felt that it would not be practical for locomotive use. The unit was rigid and there was a possibility that the differential expansion between the two large pipes could cause some trouble at the ends of the unit. To overcome these defects unit 4-C was designed. The annular steam path with a large heating surface in counterflow to the gases was still maintained towards the front half of the flue where the low gas temperatures make counterflow desirable. The back end of the unit was made with four pipes and three return bends so that a flexible structure would be obtained, similar to the Type A unit which was known to be practical for all conditions of operation. At the back end of the unit, counterflow is not so essential due to the relatively high gas temperatures. This unit gave even better results than unit 4-B and was thought to be satisfactory for locomotive use. The results were about the same as for unit 4-A—that is, 50 deg. increase in superheat with a decrease in the temperature of the gases leaving the flue.

A Combination Counterflow and Double-Loop Unit in Regular Service

It was recognized that the test apparatus could furnish accurate figures with respect to the performance of the units as far as temperatures, drafts and pressures were concerned, but that the only way to judge the value of any unit from a practical standpoint was to put sets of units in actual locomotive service. Three sets of units to designs Nos. 4-A and 4-C were built and placed in

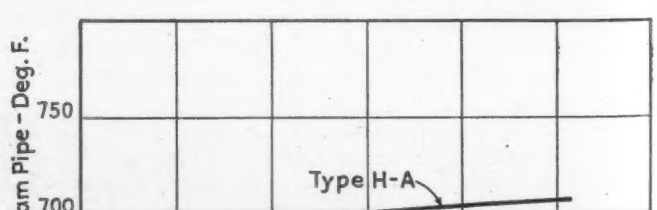


Fig. 7—Road tests of Type A and Type H-A units

service on three different railroads, thus obtaining varying conditions of fuel and locomotive operation. Trouble was encountered with the units to design No. 4-A due to the rigid structure of the unit. On one railroad it was difficult to keep the header joints tight, and on another road the header joints were tight, but the small pipes at the back end of the unit warped and split open. The results obtained with unit to design 4-C were very satisfactory and this design is now known as the Type HA unit. Approximately 200 sets are now in service and on order. Fig. 7 shows the results obtained on one railroad with the Type HA unit. The locomotive was first tested with the Type A units in the engine. The Type HA units were then substituted and further tests run over the same territory, duplicating as far as possible the same operating conditions. It will be noticed that the increase in superheat was approximately the same as that obtained in the test apparatus at East Chicago, confirming the accuracy of the method of testing.

In the discussion on a recent paper presented before the A. S. M. E. by C. A. Brandt, "The Locomotive Boiler,"* it was pointed out that a number of engines are being worked at much higher rates of evaporation than formerly, due to faster schedules and heavier trains. If the original superheater design had a small number of units, the pressure drop through the superheater becomes high for maximum rates of working. It is possible to obtain a marked reduction in the pressure drop through the units by using a single-loop design. Such a design will decrease the steam velocity and consequently the pressure drop. The decrease in steam velocity will also lower the heat transfer coefficient on the steam side so that there may be a slight decrease in superheat and an increase in the superheater unit metal temperature at the back end.

A Practicable Single-Loop Unit Evolved

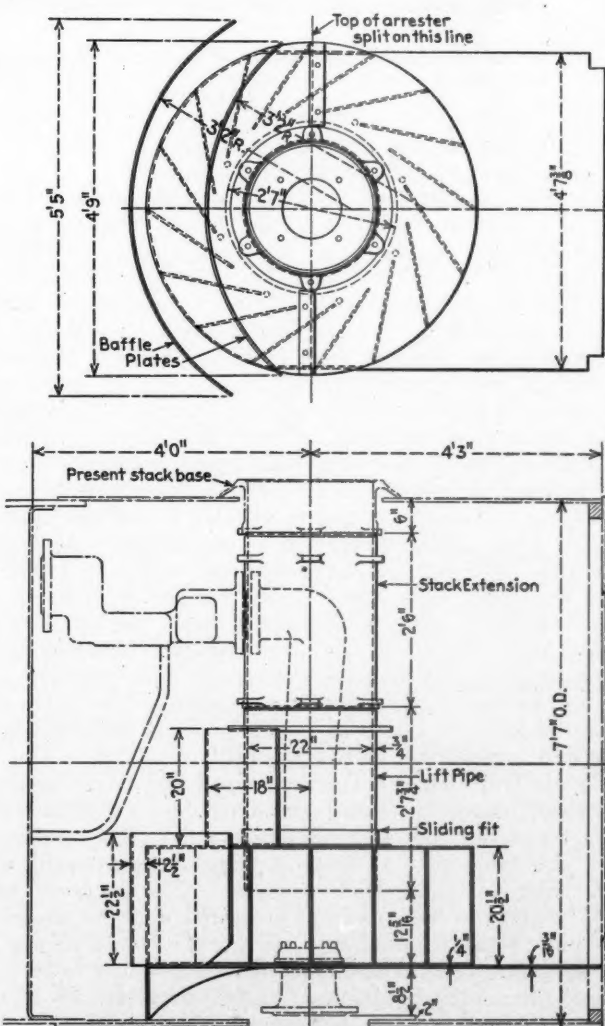
The simplest form of such a unit is shown by design No. 5-A, Fig. 6. When this unit was tested, the pressure drop was found to be very low but there was a decrease in both superheat and draft loss with an increase in the temperature of the gases leaving the flue. Evidently, there was not sufficient heating surface for proper design. Unit No. 5-B was an improvement in this respect and gave a very low pressure drop with the same draft loss as the Type A and a very slight decrease in superheat. To obtain an increase in superheat, unit No. 5-C was designed with fins welded to the pipes. The increase in superheat was obtained but there was also some increase in draft loss which would tend to offset the increase in superheat. This unit had spiral agitators for a short distance at the back end of the unit to give the steam greater turbulence and keep the metal temperatures down. The desired result was obtained with no appreciable increase in pressure drop. Apparently the length of the agitators was not sufficient to cause any great difference in the pressure drop.

Several railroads have installed single-loop superheaters in locomotives and have had considerable trouble with leaking header joints and warping of units due to the differential expansion of the unit pipes and the relatively stiff structure of the unit. Unit No. 5-B was designed for the particular purpose of overcoming these troubles. The pipes were waved for the greater part of their length to give a flexible structure that could absorb the differential expansion. At the same time the maximum flexibility was obtained in the connections between the units and the header. This unit also had the spiral agitators at the back end to control the metal temperatures. The results obtained in the test apparatus were similar to those for unit 5-B, giving a low pressure drop and approximately the same superheat and draft loss as the Type A. One set of these units has been placed in service and is proving very satisfactory with respect to troubles from header-joint leaks and warping of the units.

* See February and March, 1940, issues *Railway Mechanical Engineer*, pages 43 and 100 respectively.

The Anderson Front End

The Anderson locomotive front end was developed and successfully applied to about 150 locomotives on the Chicago, Milwaukee, St. Paul & Pacific, as described in the January, 1939, *Railway Mechanical Engineer*. Manufacturing and sales rights for this device were acquired by the Locomotive Firebox Company, Chicago, about two years ago and further improvements and developments made to adapt the new front end design to general use on railroads throughout the country. The spark arresting unit, itself, is practically unchanged from the original design, but a number of important revisions in other details tend to simplify the construction and installation of the device, lengthen its service life, increase



Details of the Anderson front-end—Superheater units may be taken out by removing the floating baffle, lift pipe and stack extension

General arrangement and method of application of improved Anderson spark-arrester—Baffles behind and above the arrester are the only obstructions to the direct flow of gases—The space under the false floor is closed at the rear

drafting efficiency and reduce materially the time and cost of all front-end maintenance work.

In early and extensive tests of the Anderson locomotive front end on the Milwaukee, it was demonstrated that this device would eliminate stack sparks and the attendant fire hazard, but, in making the application, the vertical baffle and horizontal table plates were still used with the relatively high nozzle stand, compelling all gases and cinders to take the usual paths as in the Master Mechanic's arrangement.

Netting had been eliminated, but the restrictions set up by the tortuous paths of the gases and cinders around the baffle and table plates still produced a marked reduction in the draft at the front tube sheet. In order to reduce the loss in draft and to provide a uniform draft over the entire tube sheet, the vertical baffle plate and horizontal table plates were removed. A low nozzle stand was applied and the arrester dropped down to the top of the low stand. With these changes, the stack extension was lengthened. A false floor was placed in the bottom of the smokebox to prevent the accumulation of cinders. Vertical floating baffles were installed behind and above the arrester, acting as cinder breakers, but without materially interfering with the draft.

The application of the low nozzle and lengthened stack, which heretofore has been impracticable on account of the necessity of handling all gases and cinders underneath the table plate, effects a direct improvement in draft with the same back pressure. The increase in stack height and improvement in draft conditions at the tube sheet make it possible to operate a locomotive with an enlarged nozzle tip and reduced back pressure at comparable rates of evaporation. On the other hand, if it is desired to increase the total evaporation, which may necessitate an increased coal rate, this increase can be obtained without reducing the nozzle tip to create more draft. In either case, it is claimed that a direct improvement is effected by the use of the Anderson front end as a draft appliance as well as a spark eliminator. The equalization of draft over the entire tube sheet and throughout the entire smokebox also tends to cause a reduction of cinder cutting, especially in the smokebox.

The changes mentioned were devised primarily to improve the Anderson front end as a draft appliance, but after being made, it developed that the changes greatly facilitated the installation of the front end and other maintenance work in the smokebox. The elimination of vertical baffle and horizontal table plates, together with the simplicity of the arrester unit, makes it possible to apply the arrester in a short time. With the cinder breakers made and the false bottom in the smokebox, it is relatively easy to apply the arrester, lift pipe, and stack extension.

The halftone illustration shows that, in testing superheater units, no plates have to be removed to see all of the joints in the header. All that is required is to remove two vanes in the arrester, block the nozzle, and then apply the pressure. It is not even necessary to get into the smokebox to see if the units are leaking. When all of the units have to be taken out, this can be done quickly and cheaply by removing the floating baffle, lowering the lift pipe so that the stack extension can be removed, then raising the lift pipe and removing it after the stack extension is out of the way. All of the units can then be taken out over the top of the arrester.

Experience indicates that locomotives can be turned in an eight-hour period for superheater-unit repairs when equipped with this type of front end. Units on each side of the lift pipe can be removed by simply dropping the cinder breaker without disturbing any other part of the smoke box. It is possible to apply the Anderson front end where feedwater heaters are installed without making any additional changes in the smokebox. The details of the front end are shown in the drawing.

EDITORIALS

A New Field for Steam-Locomotive Development

That the possibilities for the extension of the capacity of the steam locomotive at high speeds have not been exhausted will be clearly evident to all who read the article on another page of this issue which is an account of the tests of locomotive No. 5399 on the Pennsylvania test plant at Altoona, Pa. As in the road tests, the results of which were reported in the April issue, the performance of locomotive No. 5399, equipped with the Franklin system of steam distribution with O. C. poppet valves and in which had been installed a new superheater header with new single-pass Type A units, is compared with the test-plant performance of a standard Pacific type locomotive of the same class.

The basic design of this locomotive was laid down at a time when the extreme top speeds at which steam passenger locomotives were expected to operate were no higher than today's cruising speeds. It is not surprising, therefore, to find these locomotives deficient in capacity at the top speeds at which passenger trains now frequently operate. The really surprising fact is that so large a capacity as that developed in these tests was inherent in the basic design of these locomotives. Certainly, a locomotive with a boiler which develops an evaporating capacity of almost 21 lb. of steam per sq. ft. of evaporative heating surface per hour, which produces an indicated horsepower for slightly less than 80 lb. and, what is even more remarkable, a drawbar horsepower for less than 87 lb. of engine weight, is holding its own in the matter of capacity with the best proportioned locomotives in service today.

Such performance is the result of the removal of the restrictions on the flow of steam to the cylinders and the discharge of the exhaust from the cylinders. The restriction of first importance was in the valves. This was demonstrated in the road test described in last month's issue. Important further gains where the result of the subsequent changes in the steam passages between the boiler and the steam chest, which effected marked decreases in steam-chest pressure drop with consequent improvements in mean effective pressure.

The results of these tests confirm the conclusions reached by André Chapelon as to the importance of unrestricted passages for the flow of steam between the boiler and the cylinders. M. Chapelon employed poppet valves and steam passages doubled in cross-sectional area in the rebuilt Paris-Orleans locomotive and they were important factors in increasing the capacity of that locomotive from 2,200 to 3,700 i. hp. with an increase in weight of 11 tons.

Among the outstanding factors in the performance of locomotive No. 5399 on the test plant is the very low friction loss. From 85 per cent at the lowest tractive forces the machine efficiency rises rapidly and throughout the greater part of the range of tractive forces developed on the test plant lies between 90 and 95 per cent. Attention should be called to the fact, however, that the friction losses measured on the test plant include nothing for engine-truck, trailer-truck, and tender-truck journal friction, nor is there any head-end loss. These facts must be taken into consideration in comparing the test-plant figures with losses between the cylinders and drawbar measured in road tests.

The results of these tests open an era in which poppet valves and adequate cross-sectional area through the entire chain of passages from boiler to exhaust nozzle provide the means for developing great locomotive capacity within conservative limits of size and weight.

Oranges and Car Wheels!

Almost every one has, at one time or another, watched the operation of squeezing oranges in one of the several ingenious mechanical contraptions now used for this purpose in restaurants and homes, but how many recognize the law of diminishing returns so clearly exemplified in this homely illustration. The first partial turn of the handle produces a golden flood of the health-giving juice. The second application of pressure produces a less generous response, the third still less and subsequent efforts practically none. Unquestionably, a few drops of entirely nutritious and highly-desirable juice are left in the discarded orange pulp, but the time and work involved in reclaiming them would be all out of proportion to the benefit derived.

Similarly with freight car wheels, is it not possible that strenuous efforts to secure the last possible mile of service life before scrapping may cost more in the aggregate than that service is worth. In a recent discussion of this matter by a group of practical car men, the thought was expressed that partly worn cast iron wheels should be renewed when the cars are in the shop for repairs even if the wheels have not quite reached the condemning limit for wear. In justification of this practice, it should be recalled that the Association of American Railroads' price for a pair of 50-ton capacity new cast-iron car wheels, exclusive of the axle, is $31, and if the average life of cast-iron wheels is assumed to be 80 months, the service value per month is 39 cents. In the case of partly worn wheels which might possibly remain in service for another five

months before reaching the wear limit, the scrapping of these wheels at the time other car repairs are made would mean the loss of five times 39 cents, or $1.95. On the credit side of this transaction, however, must be charged the saving in cost of a possible train delay, switching the car with limit-worn wheels out of the train, hauling the car to and from the repair track, and losing several days service of the car because of having to renew the wheels five months after the car has been turned off the repair track.

Since the detentions of loaded cars enroute are caused primarily by defective wheel conditions, and in view of the ever-increasing urge for more reliable service in modern high-speed operation, it would appear to be false economy to endeavor to "squeeze the orange" of wheel service life too tightly. The indications are that it is better practice and money will be saved in the long run by changing wheels with less than four to five months of prospective service life whenever system-owned cars are on the repair track for other work.

Standardization—Of Errors

During these past 10 years attention has constantly been drawn to the fact that the time to prepare for war is in time of peace and that the time to prepare for the day when increased traffic on the railroads would require better maintenance facilities was during the time when the pressure of business was light enough that carefully prepared plans could be made for the completion of a program of rehabilitation of facilities as soon as capital was available. A few of the more far-sighted roads made such plans and have been making the necessary purchases to bring their facilities up to the requisite standard for some time in the past. This is not only true of motive power and rolling stock but is also true of shop and enginehouse facilities. One eastern railroad is now well along on a program involving the expenditure of approximately a million dollars for machine tools and shop equipment alone. This road, among others, will probably be in a position to cash in on any improvement in traffic by lower operating expenses as a result of the use of modernized facilities.

Times such as these do peculiar things to the thinking processes of people. There seem to be those who have been so overcome by the "terrible urgency" of the present situation that they have focused their attention on production as the main objective, "get it any way you can." Far be it from this publication to suggest that every effort, in every industry that is essential to national defense, should not be devoted to increasing the production of those things that are vital to our national welfare. But, when a railroad man sends us a story telling how, in the demand for production, his company has permitted, yes, we might say authorized, the expenditure of real money for the rehabilitation of machine tools that are 30 and 40 years old that's where we stop. The justification for spending money to put obsolete machine tools into service again is that the railroad industry can't get new ones "for love or money." Would it be out of order to ask the question, "Why not?"

Back in 1935 an important railroad spent $227,000 for new machine tools. In the normal course of events, this road probably would be pretty well satisfied to have this equipment pay for itself in 10 years. These tools were installed and in operation in 1936 and within one year had indicated a reduction of well over 20 per cent in the cost of locomotive repairs. For the years 1936, 1937 and 1938 the shop in which they were installed operated at only 30 to 50 per cent of its capacity—this is potential shop hours of about 2,500 a year. In 1939 and 1940 things began to pick up and now in 1941 the shop is running at 100 per cent capacity on the first shift plus a substantial amount of second-shift work. On March 31, 1941, the savings effected by these machine tools was 76.4 per cent of the original investment. So much for the value of modern machine tools.

Today, in order for an industry to get machine tools it has to have a preference rating based on the importance of the work it is doing. Early this year the executives of every railroad that is a member of the Association of American Railroads received a letter from the Association's president transmitting copies of applications for preference rating together with instructions for making such application. It is evident, from some conversations we have heard lately that there are railroad men who still do not know that the railroads are considered an essential industry and that if they fight hard enough to get a preference rating for facilities and tools that are needed for the proper maintenance of equipment necessary for the transportation of materials to be used in connection with national defense they probably will succeed just about as well as the other important industries. It is also well to remember that there are certain types and sizes of machine tools and shop equipment that are easier to get than others and it is possible that some of these types and sizes are in the category needed most by the railroads.

We repeat again that any railroad officer that authorizes the expenditure of money for the maintenance or rehabilitation of obsolete machine tools or shop equipment is throwing his company's money away because he is perpetuating—standardizing, possibly—an error that has been made many times over. A day's labor at 83 cents an hour costs a railroad $6.64 and if this labor is expended on a machine tool that can produce only 10 pieces a day instead of 20 or 30 pieces the answer is obvious.

Don't standardize errors—and don't assume that you can't get needed new facilities until every effort has been exhausted.

Periodic Repairs To Freight Cars

There is probably no surer method of securing increased efficiency and greater economy in car-department operation than by the periodic attention to freight cars and the scheduling of repairs on an orderly basis at regular fixed intervals instead of relying on antiquated hit-and-miss methods. Periodic general-repair programs have been developed on many railroads for locomotives and passenger cars and this method apparently is almost equally adaptable to freight equipment. The best overall results will not be attained, however, until light repair work on freight cars also is systematized so as to keep both new and older cars in safe and serviceable condition at minimum cost.

The Chicago, Milwaukee, St. Paul & Pacific was one of the first railroads to recognize the possible economies in periodic freight car maintenance and has, in fact, been following such a program for the past 12 years. It cannot be questioned that this program is responsible to no small extent for the following results, as outlined by F. A. Shoulty, assistant superintendent car department, in a paper at the February 18 meeting of the Car Department Association of St. Louis: Average cost of repairs per freight-car mile decreased about 20 per cent; number of times cars were on repair track decreased 16 per cent; accidents due to equipment failures decreased 70 per cent; freight claims due to defective equipment decreased 40 per cent; safety-appliance defects reported by I. C. C. inspectors decreased 25 per cent; purchases of couplers, friction draft gears and parts, decreased 32 per cent.

The Milwaukee freight-car maintenance program provides essentially for giving general repairs to system-owned cars at four-year intervals and this is made possible by setting up a proper retirement program and repairing equipment on a predetermined ratio of car-repair cost to gross railroad revenue. To systematize light repair work, it was felt that some intermediate period of time between heavy repairs should be fixed whereby freight cars would receive a thorough inspection and what might be termed a minor overhauling and this should take place when the cars are placed on repair tracks for the periodic repacking of journal boxes, or in other words, every 12 to 15 months. This work is now being done at nine of the larger repair tracks on the Milwaukee which have the necessary forces and equipment.

According to Mr. Shoulty, "The annual inspection consists of a close examination of all safety appliances, roofs, running boards, hand brake in all its details, doors and door fixtures, interiors of the cars, couplers and attachments including draft gears, brake beams, brake-beam safety supports, foundation brake gear, wheels, axles, spring planks, truck springs and truck sides, especially on the wheel side and in other places which would be apt to be overlooked in the hurried inspection at busy transportation yards."

Work indicated as necessary by the critical inspection described is carefully performed and this annual attention, in conjunction with the four-year general repair program, has a tendency to keep cars off the repair track and assure maximum earning capacity during the ensuing year. The main idea is to give freight car equipment periodic attention without waiting for individual cars to become so deteriorated that they cannot be depended upon to carry commodity loads to destination safely and without delays due to equipment failures. Performance records indicate that the thorough periodic maintenance of freight cars, carried out by some systematic method such as that now used on the Milwaukee, produces highly desirable results in reduced car costs and improved performance.

New Books

PROCEEDINGS ASSOCIATION OF AMERICAN RAILROADS, MECHANICAL DIVISION. *Published by the association, 59 E. Van Buren street, Chicago. 508 pages. Price, to member, $4; to non-members, $8.*

The proceedings of the annual meeting held in Chicago June 27 and 28, 1940, contain the reports of committees and discussion presented at that meeting, and the recommendations of committees submitted to letter ballot of the members by authority of the General Committee. The volume also includes a summary of the report of the New York Central draft-gear recoil tests which were presented with the report of the Committee on Couplers and Draft Gears and a report on intercrystalline cracks in locomotive boilers which is based on an investigation of this subject supported jointly by the Association of American Railroads, the American Society of Mechanical Engineers, the American Society for Testing Materials, the American Boiler Manufacturers' Association, and a number of other associations and interested groups. Recorded also are the results of the letter ballots taken on the recommendations of the various committees; the officers of the association; the personnel of the various committees of the Mechanical Division, and the representatives at the 1940 meeting.

THE READER'S PAGE

Thirty-Five Years of Poppet-Valve Experience

To the Editor:

On page 17 of your January, 1941, issue, L. B. Jones charges American locomotive designers with "deep-rooted conservatism" because they continue to build two-cylinder locomotives with one-piece reciprocating valves, though he also retains the two-cylinder arrangement for his improved locomotive *E*. American experience with both simple and compound multi-cylindered non-articulated engines is recent enough to obviate any necessity for a defense of the two-cylinder locomotive.

The piston valve also retains its place because nothing better is at present available. I say this in the face of Mr. Jones' statement that valve arrangements which meet the requirements for proper steam distribution more or less perfectly are extensively used in Europe. It is assumed that he refers to poppet valve gears. If so, they are most numerous in France, where 335 locomotives were equipped as of April, 1940, according to official statistics. I do not imagine that many have been added since then. Three hundred and thirty-five locomotives is a considerable number, but it does not imply that the French have reached a final, or even a satisfactory solution of the steam distribution problem. There are, in fact, at least half a dozen radically different poppet valve systems in use on French locomotives. The French are not agreed on either the size and shape of valves or their proper position, nor do they agree on the most suitable means of driving the camshafts. Much remains to be done before any "more or less perfect" system emerges from the present large-scale experimenting. Mr. Jones might also be interested to know that it was intended to apply piston valves to a group of fifty 2-8-2 type four-cylinder compound freight locomotives under construction for the French National Railways at the time of the German invasion.

The history of the steam locomotive contains countless examples of "improved" valves and valve gears. Attempts to eliminate the much-maligned reciprocating valve have not been lacking. More than 80 years ago, George H. Corliss applied his well-known stationary-engine valve gear to a locomotive. One of Corliss's contemporaries remarked somewhat facetiously that the engine actually needed 365 valves because one had to be renewed every day in the year. This early failure did not discourage later experimenters. Between 1885 and 1898, some 50-odd French locomotives were fitted with various valve mechanisms more or less resembling the Corliss gear. They have all disappeared long since. C. W. Young's Corliss valve gear of 1904 may still be remembered on the Chicago and Northwestern.

The successful use of drop-valves and poppet valves in stationary and internal-combustion engines was drawn to the attention of locomotive designers as early as 1900. Hugo Lentz was perhaps the best known pioneer in the application of poppet valves to steam locomotives. Beginning with a small 2-4-0 type industrial tank engine in 1905, the Lentz poppet valves were tried on locomotives of assorted types and sizes in nearly every country of Europe. The older form, employing vertical valves, achieved its greatest success in the Grand Duchy of Oldenburg. Between 1909 and 1921, 48 engines with Lentz poppet valves were built for the Oldenburg State Railways. When these lines were taken over by the Reichsbahn in 1922, the engines were very shortly "mustered out" of service.

In 1920, Lentz redesigned his poppet valve arrangement, placing the valves in a horizontal plane, but still driving them from an oscillating camshaft actuated by ordinary Walschaerts valve gear. More than 300 locomotives of the Austrian State Railways were subsequently equipped with this form. Now that the Austrian railways have become part of the Reichsbahn, these engines will undoubtedly be disposed of, as they do not fit into the German standardization scheme and poppet valves have never enjoyed great favor in Germany.

Improved Lentz poppet valves, operated by either oscillating or rotary camshafts and driven by various methods, have been applied in considerable numbers in many countries since 1921. But it is not possible to detect any widespread enthusiasm for them. After using Lentz rotary-cam poppet valves on about 150 large 4-6-2, 4-8-2 and 2-10-2 type narrow-gauge engines of typical American design, the South African Railways have returned to the piston valve in all their most recent orders for new power. Several of the larger railways in British India have also reverted to the use of piston valves after extensive trials of both Lentz and Caprotti poppet valves. About 50 English engines were equipped with Lentz valves up to 1934, when the pace of the experiments appears to have slowed up abruptly. Lentz valves have been applied to at least three American engines since 1925.

Arturo Caprotti's well known poppet valve gear first appeared in Italy in 1921. By 1928, it had run its course in that country. Caprotti's gear has, however, obtained a certain degree of popularity in other parts of the world. It has been largely used in Egypt and India, among other places, but has made slow progress in recent years. A set of this gear was brought to the United States by the Baltimore & Ohio about 15 years ago.

Other poppet valve gears have been devised elsewhere in Europe, notably by Cossart and Renaud in France, and by Meier Mattern in Holland. Extravagant claims, mostly unrealized in practice, were made for all of them.

The theoretical advantages of the poppet valve operated by rotary gearings are too obvious to require extended comment. Are the practical disadvantages and difficulties insurmountable? The long list of purely transitory successes might almost convince one that they are, if it were not for the feeling that much experimental work in the past has been desultory and half-hearted. No new device can be perfected by introducing it with a great fanfare of publicity and then throwing up one's hands in despair when the first troubles present themselves. The knowledge gained from 35 years of experience with 1,500 locomotives, coupled with a whole-hearted determination to translate the potentialities of the poppet valve into actual practice, can furnish a solid basis for progress in the future.

Wm. T. Hoecker.

Suggestions for Mechanical Associations

Get the Younger Men Out

Cannot something be done to get more of the younger men to attend and take part in the conventions? For a number of years during the depression few young men were recruited. It is true that special attention has been given to this during the past two or three years. It is also true that some comparatively young men have been advanced to minor supervisory positions and a number of others are on the various staffs related to important special duties. These young men have ideas and know how to express themselves effectively.

Their attendance and participation in the conventions would undoubtedly do much to stimulate the discussion and thinking, if they were properly encouraged. Would it not be well to have a committee or some individual in each association assigned the task of getting as many of these young men as possible to the conventions and seeing that they are made use of when they do get there?

C. D. O. A. and Contaminated Cars

There was an interesting discussion at the last meeting of the Car Department Officers' Association in the matter of loading contaminated commodities in freight cars. When you receive the proceedings please note the approach to definite action taken and the possibility of really taking that action next year. This question is so important from the standpoint of expense and shipper dissatisfaction that you could well play on this, to the end that the various departments interested will secure enough backing from the different associations to permit establishing the changes in practice necessary to eliminate this wasteful use of cars. The claim men got behind this strongly several years ago, when a number of horses were poisoned by oats fed to them after moving in a box car, which had carried a previous load of arsenic and had not been properly cleaned.

Financial Support Necessary

Those of us who are fighting to rebuild the mechanical associations have no easy task, even though we have made a fairly good record in the past two years. We were forced to discontinue our meetings during the depression years. This "shot" our membership and our administrative group all to pieces. It takes something more than time and patience on the part of a few good, highly interested souls to carry on an organization. It takes money to prepare and distribute reports and money to publish proceedings. To get this money we must have membership dues. If we can get sufficient members we can do quite well with modest dues, almost nominal, in fact. The problem is to get the members. You folks on the *Railway Mechanical Engineer* have blazoned forth the value of the associations. You have turned your columns over for practical suggestions on how to make the work of the associations more effective. Won't you please urge mechanical department officers to put their shoulders to the wheel and do their little part by joining up and sending in their dues?

Snappy Meetings

I got a bit disgusted last year because some of the sessions were not started on time; in other instances the presiding officer was rather careless and lax in keeping the program moving along in a business-like way. I realize, of course, that we are not all born presiding officers; as a matter of fact, few of us have had much experience or know just how to conduct a meeting. I have learned from embarrassing experiences that you just can't get up at the presiding officer's desk and expect to make good without a considerable amount of forethought and planning. In other words, you have got to be prepared to meet difficult situations and to take the bull by the horns to keep the meeting running smoothly. Don't mistake me, however. It may be quite necessary to pause at times, to give those present time to collect their wits and indicate that they want to speak. It doesn't do to get nervous and pass on to another subject, or adjourn a meeting in a rush, because people don't jump to their feet and take part in the discussion. Sometimes an awkward pause is necessary to smoke them out, but when they once get started your troubles are usually at an end. Moreover, you can do this sort of thing in such a way as to keep the meeting well in control. Please insist, also, on quietness and order at all times. A few careless spirits moving about, or trying to whisper with husky voices, may spoil the meeting for many of the members and prevent it from being as effective as it might be. It sometimes takes a little nerve to make the boys maintain order, but that is the presiding officer's job.

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Comments from readers on suggestions made in our November, 1940, number for making more effective the efforts of the Mechanical Department Associations. See also January number, page 25; February, page 70; March, page 109, and April, page 144.

Everybody Push!

Fundamentally, good committee reports form the basis for successful conventions. It is conceivable that without them a meeting might appear to be a success on the surface, if some live topical discussions could be staged. Quite likely, however, it will lack in real substance and may have only indifferent results, so far as practical accomplishment is concerned. What does this imply at this particular juncture, less than five months before the meetings will convene in Chicago, late in September? It means that every member of the four associations has some very specific responsibilities. The officers, entrusted with leadership responsibilities, must check up and use their individual efforts to the limit in following up the work of the various committees. The committee chairmen are on a particularly hot spot, for to be most effective their reports must be completed and be in the hands of the officers within a few weeks, at most. The committee members, if they have not yet done so, should send their material to the chairman and complete such assignments as have been made to them. Oh, yes! They may plead heavy business and all that sort of thing, but from the standpoint of better and more efficient railroad operation and to meet national defense demands, successful meetings next fall may play a very large part. The members of the associations who have no special assignments, cannot duck responsibility. They should look over their programs and contact with any of the committees to which they can supply helpful information or suggestions. Moreover every committee member should be busy boosting his association and helping increase the membership. Now is the time for every one to roll up his sleeves and push.

Reporting Back to the Boss

I do not think it is at all a bad idea for a man who has attended a convention to write a letter to his superior, thanking him for the opportunity of attending, or about something he may have seen or heard, which either interested or inspired him. Any real value which men may get from meetings of and contacts at a convention is, however, something more fundamental than that. A good idea is one with meat on it—something which has to be digested and chewed over—something which can be turned over and mulled until eventually it gives up its value in the sinews of action. If a man gets inspiration to try out something new or radical at a convention, as a result of anything which may have stimulated him in any session, it is not apt to be "jelled down" to a full-fledged plan of action, ready to put on paper for a report to the boss next week.

H. H. Carter, master mechanic of the Plains Division of the S. P. & W., made a few choice remarks that blistered the paint on the office wall

WHEN THE SCRAP HEAP YAWNS

by

Walt Wyre

When the federal inspector slapped a Form 5 on the 5097, H. H. Carter, master mechanic of the Plains Division of the S. P. & W., made a few choice remarks that blistered the paint on the office wall. Jim Evans, the roundhouse foreman, has a hide that is almost puncture proof and Carter's vituperation stung the foreman.

"And to make matters worse," Carter continued, "the 5097 has just been off the drop-pit a little more than three weeks. If them mail order mechanics you've got can't do better work than that, there's likely to be some new faces around here!"

"The mechanics we have are all right," Evans defended. "They are good as you'll find anywhere."

"Then why"—Carter started to pound the desk and remembered his fist was already sore—"then why is it an engine right off the drop-pit gets a Form 5 on account of driving boxes pounding?"

"There are several reasons," Evans explained, "but the main reason is the driving boxes were all out of round and new brasses can't last long when they just fit the driving boxes in spots. I mentioned that when I asked for a slotter over a year ago."

Carter having blown off all of his surplus steam was ready to reason. He scratched his head thoughtfully,

then said in a milder tone, "You know a Form 5 is hard to explain but maybe we can make it somehow. You know they are dismantling the back-shop at Clinton, don't you?" he added.

"Yes, I'd heard they were going to."

"Well, there's little or no chance of getting any new machine tools now, but maybe there's a chance of getting some there. I believe they have a slotter," Carter said.

"Wonder if they have an 18-inch lathe we might get?" Evans asked.

"Well, I'll find out," Carter said and picked up a letter indicating that the interview was over.

The foreman picked up his hat and started back to the roundhouse. He stopped at the storeroom. "How about the material for the feed-water pump on the 5092?" Evans asked the storekeeper.

"Not yet," the storekeeper replied. "The defense program is making all kinds of material mighty slow."

"Guess that's as good excuse as any," Evans said dryly as he turned to go.

The foreman walked through the roundhouse pausing at intervals to check up on engines and figure when they could be ready to go.

Evans stopped at the 5093 and stood a minute or two watching a machinist and helper that were busily engaged holding up one side of the locomotive by leaning against it.

"We're waiting for a back end main rod brass," the machinist explained; then said to his helper, "Maybe it's finished now."

"How much more have you got on her?" Evans asked.

"A middle connection bushing on the other side is all except a bushing for this main rod," the machinist replied.

Evans went to the machine shop to see if he couldn't uncork the bottleneck, but there was very little he could do about it. The bushing for the main rod was finished and in the tool room waiting to have grease holes drilled in it. The drill press operator was down on his hands and knees scanning the floor.

"Lost something?" Evans asked.

"Yes, the balls came out of that upper bearing and scattered all over the place. I've found all but three of them. They haven't got any balls of the right size in the storeroom," the drill press man added.

"Couldn't you drill that bushing on the old big drill press?"

"It's all set up to true the holes in the back end of a main rod," the drill press operator said. "It won't take long to get this one going again if I can find them balls. It takes about thirty minutes to change that other drill press and get it set up with the boring bar again."

Evans dropped down on one knee. "Ouch!" he exclaimed. "Here's one of your balls if I can dig it out of my knee cap."

It took about ten minutes to find the other two and approximately the same amount of time to get the drill press going again. The foreman went to the storeroom to order a new ball bearing for the drill press.

"Have you got a parts catalog for the Willer drill press?" he asked the storekeeper.

"No, that company has been out of business more than ten years," the storekeeper replied. "Don't you remember we tried some time ago to order gears and bearings for it and finally had to have them made special?"

"Yes," Evans replied. "I remember, and I also remember the repair parts cost nearly as much as a new machine on account of having to be made special. The master mechanic sure did holler about it."

"Anything else you need?" the storekeeper asked.

"Yes, some balls for the spindle thrust bearing on the drill press, but I'm not sure of the size. I'll find out and let you know."

A FEW days later there was a memorandum from the master mechanic saying that a slotter and an 18-inch lathe from the dismantled shop should reach Plainville in a few days. A motor and starter for the slotter was also being shipped.

"That'll make it just right," Evans commented. "We'll hold up the 5090 and true up the driving boxes."

Next day a flat car containing the machines was set in at the machine shop. Evans, anxious to get them in service, got a gang of men and shoved the car into the machine shop so that the overhead crane could be used to handle the machines.

"Looks pretty tall," one of the men commented and pointed at the slotter.

It was pretty tall, in fact, the top of the slotter was nearly a foot too high for the machine shop crane to pass over it. Evans walked around the car and sized the slotter up from every angle, but it was no go. The machine was too top-heavy to take a chance on hooking down low and much too heavy for the portable crane to handle.

"Guess we'll have to call the bridge gang and have them unload it," Evans finally admitted after dismissing every idea he could think of for using available means he had.

The bridge gang was busy and couldn't get at the job until next day, Evans was told when he called the master carpenter. Next morning the bridge gang foreman came and looked the machine over. About two hours later a motor car came chugging up the track pulling two push cars loaded with enough heavy timbers to bridge a fair sized creek. The balance of the day was spent by the bridge gang as follows: One hour unloading timbers and stacking them; two hours jacking up the slotter and building a crib under it; one hour letting the slotter down and removing crib; thirty minutes loading timbers used on the job; one hour loading timbers not used on the job. By that time it was 4:30 and too late to think of trying to haul the timbers back to the lumber yard and unload it, so the gang left the loaded cars set on the spur by the side of the machine shop and put in the other thirty minutes calling it a day.

After the slotter was unloaded from the flat car it could be handled with the machine shop crane. Evans had a machinist and helper set the machine in place, then he looked it over. The machinist was examining it also.

"It's not fair," the machinist observed to no one in particular.'

"What's not fair?" a helper asked.

"Cheating the Japs out of scrap iron," the nutsplitter replied.

"Maybe it's better than it looks," Evans said. "Guess we'll have to make a gear for the table feed. That one looks like it's seen its best days. Where is the motor?"

"That must be it over there," the machinist pointed at a large crate. "It looks big enough to run the whole machine shop."

The motor was 15-horsepower slow speed and of a type that was built when manufacturers considered size an asset.

"Good gosh!" Evans exclaimed, "we can't hang that thing on the slotter; it would turn it over. Besides, there wouldn't be room to walk around it."

"Where are you going to put the countershaft?" The machinist indicated a cumbersome countershaft and four-

step cone pulley that brought back memories of whirling wheels, a criss-crossed maze of belts with jingling rings polishing miles of shafting that went out of style with peg top pants for men and hobble skirts for women.

"We'll not use them," Evans said. "And we'll have to get a smaller motor. Find the electrician and see if he can't locate a motor we can use."

"There is a spare 5-horse motor in the electric shop," the electrician said. "I believe it will be large enough."

"O. K., we can try it," Evans agreed. "What size pulley will we need?"

"How fast do you want the slotter to run?" the electrician asked. "The motor runs 1760 revolutions a minute."

The foreman measured the large pulley on the slotter and did a little figuring. When he had finished he shook his head. "Can't use a flat belt. The motor pulley will have to be only about four inches in diameter. Have you got some V belts in the electric shop?"

"How are we going to change the speed?" the machinist inquired.

"Have to just run it at one speed at least for the present," Evans said. "Soon as the electrician gets the motor up here, make a V belt pulley for it and have the blacksmith make some brackets to mount the motor on the side of the slotter. I guess a piece of 5/8-inch boiler plate with some slots for the motor base bolts will do to fasten the motor on."

The machinist did a neat job of mounting the motor as outlined by Evans and in reasonably short time. At the same time the electrician was running a line of conduit and wiring for the motor and starter. The job was finished, at least they thought, next day after the slotter was unloaded.

"Ready to run?" the electrician asked.

"Let her go!" the machinist said.

The electrician pressed the starter button and the machine started.

"Stop it!" the machinist said.

"What's the matter? Ain't it running in the right direction?"

"Yes, but the pulley on the slotter will have to have the crown faced off. All of the belts are trying to climb to the center."

Facing the pulley was a fairly simple job, but getting it off was something else. At some time the pulley had evidently worked loose and some one had made certain it wouldn't happen again by welding the nut shaft and pulley hub into one solid mass. To make matters worse, the nut was back in a recess where it couldn't be readily reached with a chisel to chip off the weld. A cutting torch did the job in a very unworkmanlike manner.

Two days were spent making a gear for the table feed, building up and grinding a ratchet pawl, tightening loose bolts, and otherwise going over the slotter.

When it was finished, Evans told the machinist to look over the 18-inch lathe and see what parts were needed to put it in running shape. He also asked the storekeeper to see if there was a suitable motor available anywhere on the system.

The lathe, like the slotter, had been a good one in its day and both may have served in the preparation for the first world war.

"What do you think about it?" Evans nodded in the direction of the antiquated lathe.

"The bearings are worn, there's about half an inch play in the feed screw, it needs a new tool post and cross feed, the tailstock is off centre, the taper in the head flares so it won't fit a straight taper, and I found one gear that doesn't have any teeth broken," the machinist said.

Evans groaned. "You forgot to mention that the ways that the tailstock rides is battered."

"Yes, and one leg is cracked almost through," the nut-splitter said cheerfully.

"Well," Evans sighed deeply, "guess we will just have to order a bunch of new parts. Check the gears needed and get dimensions and pitch. I'm sure they'll have to be made special. Might as well tear the lathe down completely, and we'll do the best we can to put it in shape to run. Give me a list of parts and I'll see what can be ordered and we'll make the rest. Being away out on the tail-end of the railroad has some advantages, but there are drawbacks, too. Most of the equipment we get comes out here to dodge the scrap heap." Evans turned and went back to the roundhouse office hoping for a few minutes rest, but he didn't find it.

"The dispatcher wants two 2700's or one 5000 quick as possible. A bridge burned out on the C. T. & W. and they are detouring a hot shot train over our road," John Harris, the roundhouse clerk, said.

"What's the matter with their engine?"

"It's a coal burner." Harris didn't need to add that the S. P. & W. no longer has coaling facilities on the west end.

"Tell the dispatcher to take his choice, two 2700's or one 5000—we haven't got either!" Evans started for the door. "I'll let you know in a few minutes, but it'll be a 5000, if any."

Evans went to the roundhouse, did a little figuring, OK'd several jobs on the 5091 that should have been done, came back to the office and chanced another Form 5 by running the engine. He then sat down to worry about what engine to use in the place of the 5091 that had been marked up to run that night. The foreman had little time to sit and accumulate wrinkles; the chair seat was barely warm when machinist Cox came in.

"Did you figure on trueing up the driving boxes off the 5090?" Cox asked.

"If the slotter is ready to run," the foreman said. "I held the engine up waiting to get the slotter in condition so I could true up the driving boxes. Did you caliper the boxes to see how badly out they are?"

"Yes," Cox replied, "and they sure do need it. The brasses I pressed out of the boxes were shimmed with everything from tobacco cans to Murphy roofing and then didn't fit."

"I'll go with you," Evans said.

The old slotter had been scraped and painted. It looked nice at a little distance and not so bad close up if a person didn't look too close and see that all of the nickel plating had worn off the control wheels and lever handles leaving them dull and ugly.

"Well, if it does as well as it looks, it will be good enough," Evans commented. "Have you tried it out yet?"

"Just a little to see how it works. I cut the teeth on the feed gear with it," the machinist said.

"Pretty fair job." The foreman stooped and looked at the gear. "How did you lay it out?"

"Just clamped the old gear to the blank and turned the table feed by hand," Cox said. "It took quite a little time."

"Yes, I can imagine it did. If our defense material had to be turned out on machines like this, the war would be over before we could build anything to fight with. Guess you might as well start on those driving boxes and see what it will do. I'll be back after awhile and see how you are getting along."

The machinist had not operated a slotter for some

time and he was a little slow getting the driving box set up and the tool set, but he made it. The first cut he started was too heavy for the aged machine. The tool chattered like it had a chill when it bit into the metal. Cox eased up on the cut and it did somewhat better. He first thought that one cut would be enough but soon found that two or maybe three would be required to true up the driving box.

Just as the final cut was being made, the master mechanic came in. The official walked slowly through the machine shop looking around as he went. Then he spied the slotter and walked over to the machine.

"Pretty good-looking machine," the master mechanic said. "How does it work?"

"Just fair," the machinist told him. "It works pretty good on a short cut, but the tool post won't stand very much cut on a long stroke."

The master mechanic stood and watched until the driving box was finished, then stooped to examine the bright surface of the newly machined metal.

While he was examining the driving box, Evans came into the machine shop. The foreman came over to look at the driving box. "Is this the first one you've finished?" Evans asked the machinist.

"Yes," Cox replied. "It's pretty slow."

"Well, anyway, you won't have any more excuses that crown brasses pound out because you haven't got a machine to true up the driving boxes," the master mechanic remarked.

"Let's see your calipers," Evans said to the machinist.

The machinist handed Evans a pair of inside calipers. The foreman adjusted the calipers and measured the opening in the box at each end. He frowned and looked at the calipers, then measured again.

"It would be all right if the brasses were made tapering to fit," Evans commented as he handed the calipers to the master mechanic.

"What's the matter?" the master mechanic asked.

"Tool post guides must be worn," Evans replied. "There's nearly three sixteenths of an inch difference in diameter between the two ends of that box. That's just about as bad as being out of round. Better see if you can't take some of the play out before you do the next one," he added to the machinist.

"Maybe you can get it fixed up in fair shape," the master mechanic said. "How is the lathe? When will you get it going?"

"Can't say," Evans shrugged his shoulders. "We've ordered a lot of gears and other parts that are needed to put it in shape to run. If we don't count the time put in on it, the lathe won't cost much more to repair than it would to buy a new one and chances are we wouldn't have got a new one anyway."

Fabricated Hinge Crossties

The group of four hinge crossties, illustrated, are designed for use in the front engine frames of articulated locomotives. They were fabricated completely by the welding together of steel plates at the Union Pacific locomotive shops, Omaha, Neb., and have the advantage of great strength combined with relatively light weight. They are made for the most part of 1-in. boiler plate cut and bent to the shapes indicated and welded together with suitable reinforcing inside ribs welded in place wherever necessary to give the required additional strength and stiffness.

Considerable ingenuity was exercised in designing this

Welded hinge crosstie for articulated locomotive fabricated from shapes and plate

hinge crosstie so as to minimize the number of individual plates required and hence reduce the welded joints to a minimum. For instance, the top is blocked out and offset, by far the greater part of it being in one piece. The base is made in one piece, cut to the required shape by means of the oxy-acetylene pantograph machine. The rounded part of the side is made in one piece and formed in a bulldozer. Flat parts of the sides are, of course, separate pieces and smaller rib reinforcing plates are cut separately on the pantograph machine, being scarfed so as to leave the edges at the correct angle for welding.

After all parts are suitably formed they are set in an assembly jig and all inside welds made. The bottom cover plate is then applied and the outside rims welded. A 14-in. by 9½-in. steel bushing is then pressed in, as illustrated. After completion of the welding, the crosstie is normalized at 1,550 deg., and drawn at 1,000 deg. F.

For a hinge crosstie of the size illustrated, it takes two men about 32 hr. to complete the welding operations,

Front engine hinge crossties for articulated locomotives fabricated by welding at the Omaha shops of the Union Pacific

$^3\!/_{16}$-in. shielded arc wire being used and deposited at the rate of approximately 3 lb. per hr. The finished crosstie weighs about 1,500 lb.

The bottom pin hub and spring housing, shown in the right foreground of the illustration is made of one piece of 1-in. boiler steel, 36 in. by 84 in., cut on a pantograph and bent in a bulldozer to the shape shown. Only one weld is required on this job to apply the front plate (not shown in the illustration), also one rib and one bushing. This type of construction assures an unusually strong and rigid assembly and one which has high strength per unit of weight.

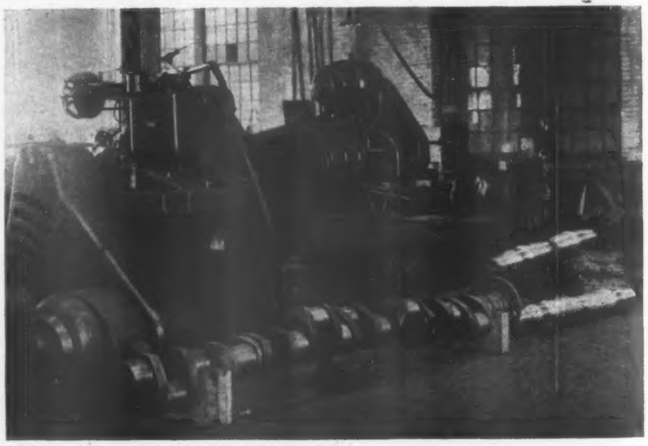
Grinding Diesel-Engine Crank Shafts

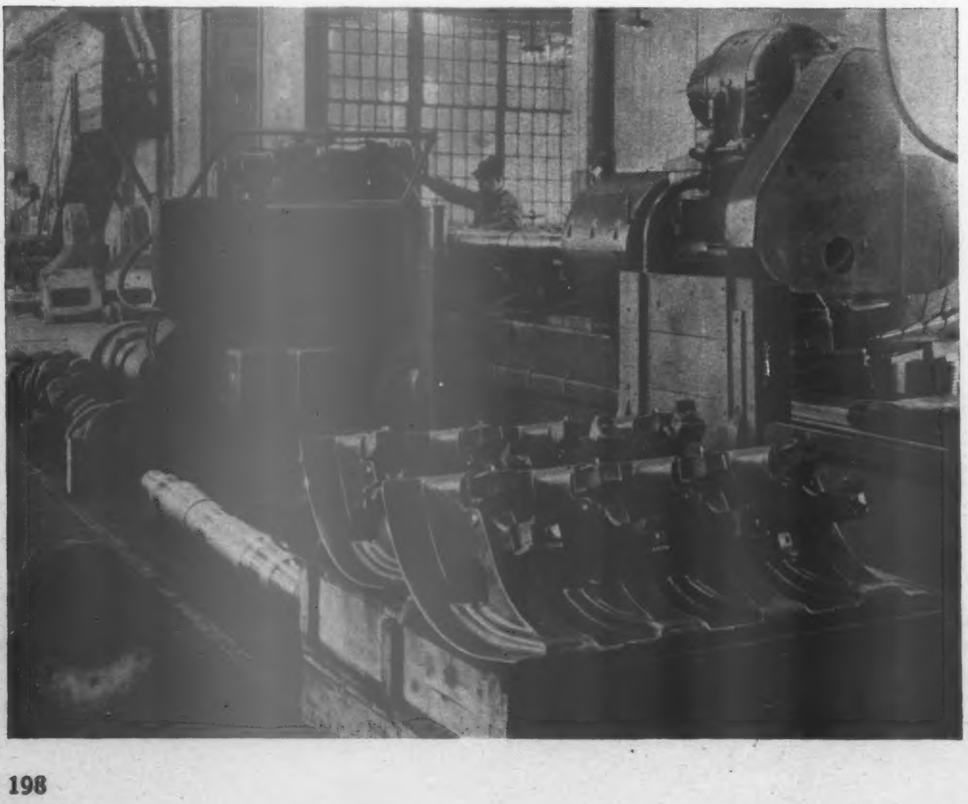
The job of grinding Diesel-engine crank shafts is more or less of a specialist's work and requires considerable experience before entirely satisfactory results can be secured. Worn bearings are checked for quarter and stroke and an attempt made to hold all bearings to the same size and accurate within 0.001 in. Crank shafts which have seen considerable service and wear are ground in step sizes of $^1\!/_{32}$ in., so that both main and crank-pin bearings, supplied in these standard sizes, may be readily installed both when the reconditioned crank shaft and Diesel engine are placed in service and also subsequently when, for any reason, a bearing may give trouble and have to be replaced by a new one from stock.

These operations are performed on a large cylindrical grinding machine built by the Landis Machine Company, Waynesboro, Pa. This machine has a capacity to swing work 29 in. in diameter by 169 in. long between centers. The first operation is to make a plunge cut with a 4-in. wide grinding wheel and then traverse the wheel for the width of the bearing. Scored bearings are cleaned up and all roughness removed, the bearings being reduced to the next $^1\!/_{32}$-in. step size in diameter.

Before the actual grinding operation, however, one of the most important jobs is to counterbalance the crank shaft so that it will revolve smoothly and apply steady rests to eliminate all possible flexing and chatter of the crank shaft. This is necessary whether main or crank pin bearings are being ground. The Diesel-engine crank shaft, as received dismounted from the engine, is shown in the foreground of one of the views resting on three blocks on the shop floor. As a matter of fact, the weight of this crank shaft itself in connection with its length is sufficient to cause some slight flexing and, when supported between centers in the grinding machine, it is said that the operator can move one of the center bearings out of line as much as .02 in., by a strong hand pull. In attempting to grind these bearings throughout the length of the crank shafts to an accuracy of .001 in., therefore, the importance of the greatest care in counterbalancing the shaft and eliminating all possible flexure and vibration is at once apparent.

In one of the views, taken from the back of the grinder, a group of eight steady rests used in grinding Diesel-engine crank shafts is shown in the right foreground, and one of the two combination centering and counterbalancing fixtures used in supporting the crank shaft between





Above:—Rear view of Landis grinder with a Diesel engine crank shaft shown in the foreground ready to have the bearings ground. Left:—The grinder is used at the U. P. Omaha shops for refinishing Diesel engine crank shaft bearings, also locomotive and car axles, etc.—Counterbalanced centering fixtures and steady rests in the foreground

grinder centers is shown in the left foreground. This combination fixture is particularly ingenious in that it is designed to be clamped on the end of the crank shaft, carry adjustable counter plates which may be varied, dependent upon the type of crank shaft being ground and be designed to support the crank shaft between grinder centers in any one of eight balance angular positions, dependent upon which crank pin or bearing is being ground. The change in angular position of the counterbalance plates permits this one fixture to be used for grinding all of the bearings on a single Diesel-engine crank shaft without adjusting the counterbalance plates for each new bearing to be ground, as would otherwise be necessary.

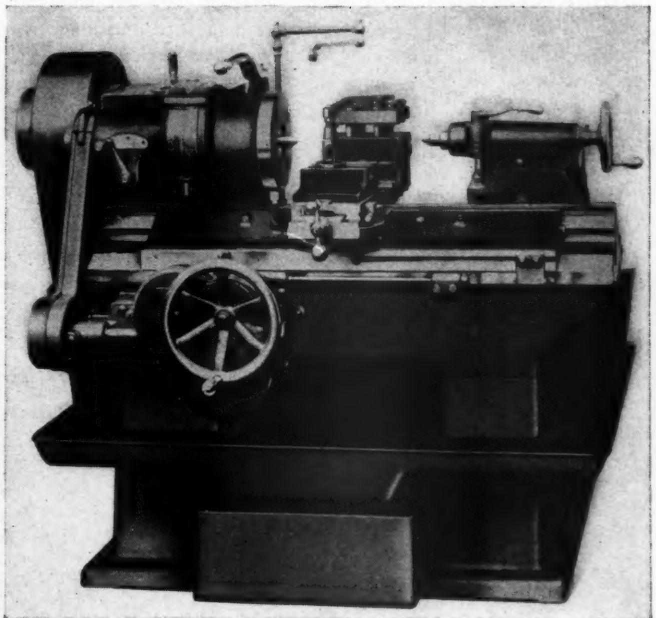
View of the Landis grinder from the operator's side of the machine, showing conveniently located grinder controls

While the Landis cylindrical grinding machine was installed primarily for grinding Diesel-engine crank shafts, it is also used for grinding locomotive axles used with roller bearings and also grinding all over the car axles used in streamline trains to remove all tool marks and stresses from turning operations which might cause progressive fractures. The Norton grinding wheel is 38 in. in diameter by 4 in. wide and revolves, for most work, with a surface speed of 5,000 to 6,000 ft. per min.

Multi-Cut Lathes for Turning and Facing

The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, has developed 6-in. and 9-in. multi-cut lathes designed for the easy set-up of separate tools for turning, facing, necking and grooving cuts. All of these cuts go through their cycles and finish at the same time. The operation is automatic from the time the work is put into the lathe, the lead tool brought up to the work and the power and feed lever thrown into action. At the end of the cycle of cuts, the hand wheel is used to return the tools ready for the next part to be machined.

The variation in feed for the turning and facing size is obtained by the application of change gears to the feed bracket and worm box. The feeds read in thousandths per revolution of spindle. A simple, direct-reading, work diagram shows the change-gear combination and the resulting feeds. The relationship between the slides is quickly adjusted by the setting of the movable profile swivel plate. As the facing or forming tools approach the end of the cut, the feed is retarded as the roller slides on the land of the profile guide plate.



LeBlond multi-cut lathes are designed for the easy set-up of separate tools for turning, facing, necking and grooving cuts

With these machines the set-up is simple and the machining cycle is accomplished by many tools cutting simultaneously. By this method, on the time required for the longest individual turning or facing cut depends the machine time for the piece.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Punching Holes in Firebox Sheets

Q.—Is it considered good practice to punch staybolt holes in new firebox side sheets? What size should the holes be punched in the sheets for 1-in. staybolts, and for ⅞-in. rivets?—A. L.

A.—It is the accepted practice with many railroads and with the locomotive builders to punch the holes in the firebox side sheets for both rivets and staybolts. When punching staybolt or rivet holes, the metal around the punched hole becomes strained and distorted. It is important that the punched hole be made of such diameter that the strained and distorted metal around the punched hole is completely removed when the hole is reamed out. The failure to remove all of the stressed metal is often the cause of cracks starting around the staybolts.

The practice of punching holes for staybolts in firebox side sheets varies. The general consensus is that the punched holes should be from ¼ to 5/16 in. less in

diameter than the nominal diameter of the staybolt tap. The punching should be done from the water side of the sheet. For rivet holes in firebox sheets under 9/16 in. in thickness, the holes are punched 1/8 to 3/16 in. smaller than the required diameter and reamed to the required diameter after the sheets are assembled.

Chemicals Used in Feedwater Treatment

Q.—What chemicals are generally used in the treatment of boiler feedwater to prevent foaming and scale?—W. I. D.

A.—The most common chemicals used in the treatment of boiler feedwater for the prevention of foaming and scale are soda ash, caustic soda, sodium phosphate and sodium silicate.

Soda ash is what is known as a softening chemical. It reacts with the calcium or lime hardness in water. Soda ash, under the temperature encountered in boiler water, is broken down to caustic soda which reacts with magnesium. It is probably the most universally used chemical for internal treatment of boiler feedwater and most boiler compounds contain soda ash in some quantity.

Caustic soda combines with magnesium hardness and is of especial advantage in waters that contain magnesium in high percentages. Caustic soda is also used where the water is particularly corrosive due to carbon dioxide gas in the feedwater. Sodium phosphate comes in several different forms; namely, tridi-, mono- and meta-sodium phosphate. The phosphate reacts with calcium to form a sludge which is non-scale forming. The phosphates are exceedingly stable and for this reason are used extensively in high-pressure boilers.

Sodium silicate, another material used extensively in boiler compounds, is used chiefly because of the soda value in the sodium silicate. Some claims have been made that the silicate part of the sodium silicate forms a coating on the boiler metal to prevent the adherence of scale. This has not been proved conclusively and many cases are known where a silicate scale has been formed due to the use of sodium silicate compounds. Good results are sometimes obtained with this material in low-pressure or heating boilers.

Purpose of Steam Dryers

Q.—What is the purpose of steam dryers used in locomotive boilers? How do they operate?—F. A. R.

A.—The purpose of the steam dryer is to remove the water from the steam flowing into the superheater. The carrying over of the water reduces the efficiency of the boiler because the degree of superheat is lowered by the water carried through the dry pipe into the superheater. The carry-over of water into the superheater tends to cause internal encrustation of the superheater units. Steam dryers also tend to eliminate water caused by surging and foaming from entering the superheater.

There are several designs of steam dryers involving different principles. The dryers are fitted on the top of the dry pipe bootleg in the dome. One design consists of fixed turbine-shaped vanes arranged within the body of the dryer, causing the entering steam to be whirled around at high velocity. As a result the water is centrifugally separated and ejected through the tangential outlets. The fixed vanes are designed to impart a whirling motion to the steam producing sufficient kinetic energy in the separated water to return it to the boiler against the boiler pressure.

Another design consists essentially of two concentric hollow cylinders. The inner cylinder is perforated with diverging velocity nozzles and the outer cylinder wall contains a series of fixed turbine blades. The steam from the boiler flows through the fixed turbine blades of the outer cylinder and is deflected downward in the space between the two cylinders, the steam being forced to change its direction in order to pass through the nozzles of the inner cylinder. The inertia effect of the steam entering the projecting velocity nozzles of the inner cylinder and the reversal in the direction of the steam flow separates the entrained water which drains down the outside walls of the inner cylinder back into the boiler. The steam passes through the nozzles of the inner cylinder into the dry pipe.

Seal Welding on Boiler Shell Patches

Q.—In the September, 1940, issue, page 370, of the *Railway Mechanical Engineer* you have an article headed "Improved Method of Applying Boiler Patches." In Fig. 4 of this article you show a method of patching the second course of a boiler shell which calls for seal welding the filler wedge to the shell. It has always been my understanding that this welding constitutes a Federal defect. Please explain how this is got around as in some cases this would be most advantageous, if allowed. —V. L. L.

A.—The patch referred to in the question was one of the entries in the prize competition on boiler patches, announced in the March, 1939, issue. These patches are being published to give you a cross-section of boiler patches as they are being applied by the various railroads.

The patch in question illustrates a method of patching a circumferential seam without planing or scarfing the end of the patch, heating and opening up the circumferential seam and inserting the patch and then heating and laying up the circumferential seam. This was done by applying a wedge-shaped filler piece to raise the outside plate of the patch by the thickness of the shell course. This feature of the patch was considered worthy of publication. The Bureau of Locomotive Inspection proposed rules for welding provides that welding shall not be applied to any part of the barrel, dome, drum or hip sheets of any boiler unless the stresses to which the part is subjected are carried by other constructions that will maintain the required factor of safety. This will not prohibit welding of joints of shell sheets at the ends of the butt straps to seal leakage, or prohibit the welding of staybolt sleeves or caps in that portion of the barrel into which the combustion chamber extends. In all cases the railroad company is held responsible for the design, material, application, inspection and safety of fusion welding, applied to any locomotive.

The contributor of this patch states: "Our interpretation of the rule of authority for welding the wedge one inch on each side where it butts against the outside throat sheet in this particular sketch is the same as on the construction of a course, which formerly was sealed with a plug between the edge of the outside welt strip and the circumferential seam of the next course, but as you know in recent years welding takes its place. (This is permissible under the I. C. C. ruling.)

"To further explain this, would say that this weld is covered by the outside plate as well as the inside with the exception of the 1/4 in. allowed in width to make a caulking edge for the outside plate. We have made several applications of this type patch and find them very satisfactory as to cost of application and the results obtained, and cannot see any reasonable cause to question it as this weld is on the wedge only, acting as a seal as its name implies and has nothing whatever to do with the efficiency of the patch.

Questions and Answers On Welding Practices

(The material in this department is for the assistance of those who are interested in, or wish help on problems relating to welding practices as applied to locomotive and car maintenance. The department is open to any person who cares to submit problems for solution. All communications should bear the name and address of the writer, whose identity, however, will not be disclosed when request is made to that effect.)

Creeping Gages And Regulators

Q.—We are troubled with creeping oxygen gages or regulators on portable outfits. Is it safe to use these regulators?

A.—Creeping or leaky oxygen regulators should never be used and when one is found, it should be turned in to the storehouse for a new one. Not only is it impossible to maintain a suitable working pressure, but at any moment the pressure may build up in the hose and blow a hole in it causing an accident.

Removing Loose Driving Wheel Keys

Q.—Could you suggest a method for removing loose driving wheel keys?

A.—Cut off the head of a bolt with a good thread and a body size near the size of the key to be removed. Clean the end of the key and scarf the bolt for welding, either single or double V. Weld the bolt securely to the end of the key. Slip a bushing and washer over the end of the bolt until just enough bolt remains to take a full nut. As the nut is tightened, the key will come with the bolt, more washers are added, as needed, until the key is removed.

Cleaning the Orifice In A Torch Tip

Q.—Please recommend an instrument for cleaning out welding and cutting tips.

A.—The holes in cutting and welding tips are designed and drilled to very close tolerances, therefore, any instrument used to ream these holes, other than a drill of the exact size, tends to enlarge the orifice and ruin its efficient operation. The manufacturer of the equipment will gladly furnish a chart giving the correct number drill size for each tip. The drills can be used in a pin vise or soldered into the end of a 2-in. or ¼-in. bronze welding rod knurled for a firm grip.

Reclaiming Worn Valve Stems

Q.—We have a number of valve stems with the threads and tapered fits worn too badly for continued use. Can these be reclaimed by welding and if so by what process?

A.—These valve stems with worn or pulled out threads and worn out tapered fits, caused generally by loose crossheads or loose valve spools, are usually otherwise in good condition. The threads should be turned off the stem before attempting to rebuild this end. When rebuilding, use a medium size welding head, a neutral flame and a soft, low-carbon-steel welding rod: Care should be exercised in depositing the new metal to keep it free from laps, slag pockets and oxide inclusions.

Building Up Guides By Arc Welding

Q.—We weld the worn sides of guides by the electric arc process using bare electrodes. While the resulting surface is satisfactory, the operation takes so long that it is almost prohibitive. Could you suggest some method of speeding up the welding of these guides?

A.—Arc welding locomotive guides with bare rods has been a noted time killer, sometimes taking as long as 10 hours on one guide. Try substituting heavy coated electrodes for bare rods and increase the size of the electrode from the usual 5/32 in. or 3/16 in. to 5/16 in. or ⅜ in. sizes, depending on the wear of the particular guide. This method will cause little or no warping and the only precaution necessary is in depositing the initial bead along the edge of the guide. This bead must be laid about ⅜ in. in from the edge of the guide and worked out toward the edge with a semi-circular motion so as not to burn away the edge of the guide.

Cutting Cast Iron With Acetylene Torch

Q.—Can cast iron be cut with the acetylene torch?

A.—Cutting cast iron with the torch is not as simple nor as rapid as the cutting of steel. It can be done, however, with little extra effort. Use a larger tip size than for the same thickness of steel. Adjust the preheating flame so that it shows an extensive amount of acetylene. The tip must be held farther from the material to be cut, and the material will have to be preheated longer. In fact, the edges should be molten before the high pressure is used. When the cutting is started, the tip is moved from side to side very slowly. It will be found advantageous on light castings to preheat and blow away molten metal alternately.

Removing Smoke-Arch Cylinder-Saddle Bolts

Q.—Could you recommend an economical way of removing smoke-arch cylinder-saddle bolts?

A.—These bolts can best be removed with two cutting torches. One operator cuts the head from the bolt and starts piercing the body of the bolt; simultaneously, the other operator cuts the nut from the same bolt and also burns into the bolt. When the operator on the outside notices the slag from the torch inside blowing through, he removes his torch while the other operator finishes splitting the shell so that it can be driven out with a hand hammer and punch. Two minutes to each bolt is an average time.

Repairing Rusted Car Side Sheets

Q.—We have developed an unsightly condition on steel passenger coaches wherein the rust has forced the bottom of the outside sheets out below the rivets so they look very bad. Can you suggest a method of repair?

A.—This is a common occurrence and can be repaired easily. Holding a cutting torch parallel with the bottom edge of the sheet, the rusted section is burned off about ½ in. below the rivets. Care should be taken to keep the cut as straight as possible. The rust is removed and the slag cleaned from the cut and a piece of ⅛-in. band iron of the proper width is welded back in place, either with the torch or the electric arc process. The weld is ground flush and the new metal primed and painted.

Electroplating Work at Omaha

Electroplating work of all kinds for the Union Pacific System is done in a modern electroplating department. All dining car silverware is plated in this department and all hardware is nickel-plated with a satin finish and lacquered to preserve the lustre. Screws intended for use in exposed trim of passenger cars are cadmium plated to prevent rust. Arrangements are also now being made for a small amount of chromium plating on parts where a hard, durable finish with excellent wearing properties is required. In addition to electroplating, all lock and key work for the system is done in this department.

The electroplating department at the Omaha car shops occupies a space 90 ft. long by 84 ft. wide along the shop wall where excellent light during the day is supplemented by overhead electric lighting fixtures for use when needed on dark days or for double-shift operation. The equipment includes 10 plating tanks with different types of solutions. These tanks are arranged in five rows, and only part of them are included in one of the illustrations. This shows the silver plating tanks in the foreground and the two long nickel- and copper-plating tanks in the background. The latter tanks are 16 ft. long by 3 ft. wide by 4 ft. deep and have a capacity of approximately 1,500 gal. each.

Machine equipment in the electroplating department includes four buffing and polishing machines which operate at a speed of 3,600 r.p.m., two metal lathes and two sensitive drill presses. One interesting piece of new equipment recently installed is a small tumbler barrel, shown separately in one of the illustrations, which is power driven and used for nickel and cadmium plating parts such as small screws with a notable saving in time and labor as compared with previous methods.

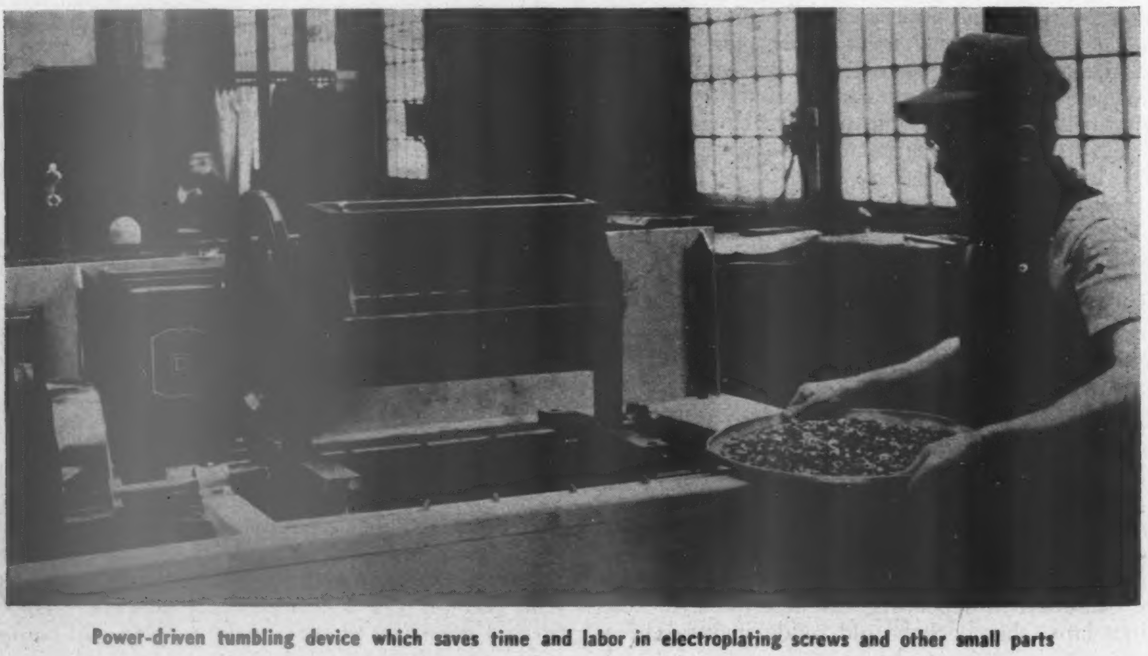
With the considerable increase in electroplating requirements at the Omaha car shops, it became necessary about a year ago to furnish additional electric power and a new 2,000-amp. d. c. motor-generator set, furnished by the Hanson-Van Winkle-Munning Company, Chicago, as shown in one of the illustrations. This motor-generator set is designed especially to meet the requirements of satisfactory electroplating and includes all necessary rheostats, electric meters, switches and control equipment, combined on two switchboards as shown at the right in the illustration.

The satisfactory application of silver plating is a specialist's work, involving in Union Pacific practice 16 separate and distinct operations, which will not be considered in detail in the present article. As many as 6,000 pieces of silver a month have been replated and refinished in this particular department at the Omaha shops.

In nickel plating also particular care is necessary to get the desired results at minimum cost. The nickel is stripped off by the electric process, using a reverse current with the nickel-plated parts suspended in an acid bath. The parts are roughed off with No. 80 emery on a buffing wheel and polished with No. 120 emery. The parts are then cleaned in an Oakite solution and pumice stoned to remove impurities which would interfere with subsequent nickel plating. After being immersed in a nickel strike for 15 min., the parts are removed and placed in a copper-plating bath for 30 min. They are then transferred to the polishing machines and brought to a bright lustre. The parts then go back to the Oakite solution for cleaning off all grease from the polishing machine, then immersed in a cyanide dip, rinsed off with clean water, replaced in the nickel solution for 30 min., removed, polished and lacquered to retain the lustre.

Plating Small Parts in Tumbler

The tumbler shown separately in one of the illustrations, has proved to be a great time saver in the nickel-plating of such parts as signal contacts and all screws, which formerly had to be plated with the use of considerable more hand labor. As many as 3,000 screws



Power-driven tumbling device which saves time and labor in electroplating screws and other small parts

The electroplating tanks and one of the silverware buffing wheels at the Omaha car shops of the Union Pacific

can be plated with this device in a period of 20 min. The device consists of a hexagonal wooden tumbler 18 in. long by 10 in. across the sides, equipped with 10 wire feelers which revolve inside as the screws are tumbled, these feelers making electric contact with the screws as they are agitated and moved about when the tumbler revolves in the electroplating bath under the belt drive from a one-half horsepower electric motor (not shown in the illustration). This motor operates at 1,720 r.p.m., with worm and gear drive to a small pulley which drives the larger tumbler pulley by means of a V-belt. The small pulley is 3 in. in diameter and the large pulley 14 in. in diameter. The nickel-plated guard, shown at the left in the illustration is applied over the worm-gear drive, both as a safety measure and to prevent oil from being splashed.

The tumbler is shown in the loading position in the illustration with one side removed for the insertion of the screws to be plated. After these are placed in the tumbler, the side is applied and held securely in place by thumb screws, the tumbler then being inverted in position and lowered into the nickel-plating solution in the tank. Electric current enters the barrel by a bus-bar connection to the center shaft and thence to the 10 wire feelers, which make repeated contact with the individual screws or parts to be electroplated. An ordinary load for this tumbler consists of 50 lb., and the current ranges from 60 to 75 amp.

The Hanson-Van Winkle-Munning motor-generator set and control equipment especially designed for use in electroplating

Induction Heater Used To Remove Bearing Sleeves

To remove the bearing sleeves (inner races) from axles equipped with roller bearings, the Erie car shops at Susquehanna, Pa., have developed an induction heater which permits this work to be completed quickly and safely. These sleeves have a shrink fit on the axle and, to be removed, must be expanded by heating. The only alternative is to loosen the sleeve by cutting which, of course, requires a new sleeve when reassembling the bearing on the axle.

The effectiveness of any method employed to expand the sleeves by heating depends upon its ability to raise the temperature of the sleeve while the axle journal remains relatively cool. Formerly, the Susquehanna shops used hot oil to heat the sleeves. The results by this method were not only unsatisfactory due to the slowness with which the heating was accomplished, the length of time required being sufficient to heat the axle as well, but the hot oil also made the operation hazardous for the workmen. The induction heater has eliminated these difficulties.

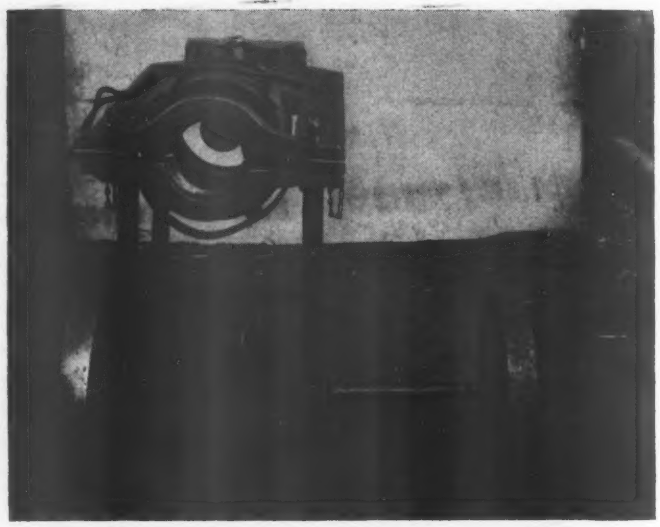
Essentially, the induction heater consists of an electric coil mounted on a carriage. In making the coil a Micarta spool, having an 8-in. inside diameter and an 8⅜-in. outside diameter, was used. This spool was wound with No. 8 Delta Beston wire, 190 turns for operation on a 220-volt line and 380 turns for 440 volts. The coil is supported by straps, as shown in the illustration, and is removable for convenience when employing the coil to heat the sleeves before applying them.

The carriage for the coil is of welded construction with four vertical supports of telescoping tubes. The inside tubes are adjustable for height, the tubes being held in position by pins inserted through holes drilled along the length of the tubes. A screw jack is mounted on a horizontal yoke, its axis being along the projection of the center line of the coil. At the front of the coil is a split collar that fits around the car journal in back of the sleeve. Collars of different diameters are available for the various sizes of journals.

When removing a bearing sleeve, the equipment is centered in line with the axle journal, the coil being placed around the sleeve with the collar fitted over the journal between the inside face of the sleeve and the wheel hub. The jack is run up against the end of the axle and tightened. This operation places the sleeve under an initial force tending to slide it off the journal. The coil is then energized by connecting it to the power source (440 volts at the Susquehanna shops). The sleeve, acting as a short-circuited secondary coil, is heated very rapidly, 25 to 35 seconds being the time usually required. As the sleeve expands on heating, it becomes loosened on the journal and is quickly removed by further jacking. Care must be used in heating because the sleeve temperature can be raised in a very short time to a point where the physical characteristics of the metal are affected. The time required for heating is so short that the journal temperature is not increased sufficiently to counteract the expansion of the sleeve.

The coil is removed from the carriage and placed in a vertical position on a wood base when it is used to heat a sleeve before its application. The heating period is timed by a watch to prevent overheating. When hot, the sleeve is handled by special tongs and slid on to the journal by tapping with a wood block. A gage locates the sleeve in its proper position on the journal.

The portable induction heater and jack

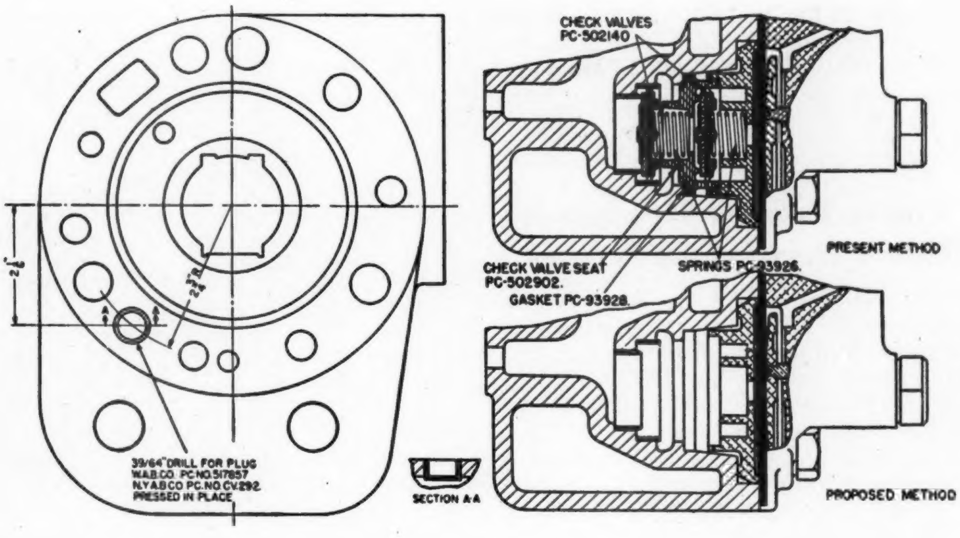


The split collar diameter can be changed to fit any journal size

Elimination of AB-Brake Refinement Recommended

The elimination of two by-pass check valves from the service portion of the Type-AB air brake valve has been recommended in Circular No. C. V.-999, recently issued by the Association of American Railroads, Operations and Maintenance department, Mechanical division, by direction of the General committee and over the signature of Secretary A. C. Browning. This circular refers to the inclusion of the two by-pass check valves which are intended to operate so as to permit an application and release of the brakes with the strainer clogged. Since none of these by-pass check valves have been required to operate in over three years of service, their removal is recommended, including the following detail parts:

Reference number	Description	Piece number
48	By-pass check valves (2)..........	502140
49	By-pass check valve springs (2).....	93926
50	By-pass check valve seat............	502902
52	By-pass check valve seat gasket......	93928



Sketch of Type-AB brake valve service-portion face, showing location of port to be plugged—Cross-sections show how by-pass check valves are discarded

The circular included the following paragraph in explanation of the action recommended: "After careful consideration and following the full examination of cars equipped with experimental Type-AB brakes, the Committee on Brakes and Brake Equipment has recommended that the by-pass check valves may be omitted without affecting the integrity of the AB valve, as it is apparent that after three years or more of service none of these by-pass assemblies had been required to operate. This recommendation was referred to the Bureau of Safety, Interstate Commerce Commission, which Bureau, in view of the facts stated above, has no objection to the elimination of these parts. These parts should, therefore, be removed and, as shown on the attached sketch of the service portion face, the port should be drilled to 39/64 in. diameter and suitably plugged."

Welding Positioner

In the assembly of products by welding, units to be handled and fabricated are often of large size and shape, requiring crane service for lifting and moving. The C-F positioner is designed to simplify and eliminate many of the motions and save much of the time required to handle these heavy and unwieldy parts. Standard features common to all models of this machine are the table tilt from horizontal to 135 deg. from horizontal, complete table rotation, table height adjustment, and table removal for the installation of special fixtures or jigs.

The rotating and tilting movements in every machine are independent in action. Hand wheels with self-locking gears control these movements in manually operated machines. Machines operated by hand have a disengaging mechanism which permits free rotation so that a balanced or circular part may be turned without the use of the hand wheel. For power-operated rotation this same action is accomplished by use of a variable-speed drive. Power-operated rotating and tilting movements are controlled by independent motors with magnetic starters and push-button control. The table-tilt mechanism includes a limit switch which cuts off the power supply when the table reaches either extreme position. The table may be adjusted for height by sliding the unit up or down the base column and pinning in position.

The welding positioner is available in four models, Nos. 12, 25, 60 and 140, having capacities of 1,200, 2,500, 6,000 and 14,000 lb., respectively. The two smaller machines can be equipped for either manual or power operation while the larger machines are power operated only. Variable-speed table rotation ranges from 0 to .67 r. p. m. in all machines except the largest where the range is from .087 to .625 r. p. m. Constant-speed table rotation is 1.6 r. p. m. for No. 12, 1.0 for No. 25, .8 for No.

Large parts are maneuvered easily for down-hand welding when attached to the table of the C-F positioner

60 and .58 for No. 140. Table tilt speed is 135 deg. in 20 seconds for No. 12, 135 deg. in 30 seconds for Nos. 25 and 60 and 135 deg. in 34 seconds for No. 140. These machines are a product of the Cullen-Friestedt Co., Chicago.

Fork Truck Designed For Congested Areas

The latest addition to the line of industrial trucks manufactured by the Baker Industrial Truck Division of the Baker-Raulang Company, Cleveland, Ohio, is its new type JOM center-control fork truck which is available in 2,000- and 3,000-lb capacities. The compactness of this model, combined with the short turning axle, makes it particularly adapted for working in close quarters. The safe and speedy handling of material is assured since the operator rides in front where excellent vision is obtained. The operator's comfort, important to increased production, has been kept in mind by the installation of a seat and an automobile-type tilted steering wheel.

A high-capacity mill-type safety contactor is interlocked electrically with the controller and the operator's seat for greater safety. This contactor relieves the controller of arcing and automatically opens the circuit when the operator leaves his seat. The travel circuit closes only with the operator seated and the controller in the first speed position. All controls are conveniently grouped in a panel at the operator's left. The absolute control of hoisting and tilting operations is obtained in the hydraulic system. A motor-driven gear pump supplies oil under pressure to the hoisting and tilting cylinders through metering valves, the excess oil being bypassed to the reservoir through unloading valves. Lowering is by gravity. The hydraulic lines are copper tubing and high-pressure wire-inserted oil-proof hose.

The frame is fabricated of high-tensile steel by arc welding and hot riveting with main sills of deep-section flange plate members running from end to end. The upright guides are formed steel channel sections. The fork carriage travels on ball-bearing rollers. The power is supplied by a single hydraulic jack with the piston movement being compounded by a pair of chains and sprockets.

The Baker-Raulang JOM center-control fork truck is available in capacities of 2,000 and 3,000 lb.

The 2,000-lb. capacity truck is designed to handle loads up to 60 in. in length and the 3,000-lb. model will handle loads up to 42 in. in length. The standard simple lift is 72 in., the standard telescoping lift is 119 in. The driving tires are 22 in. by 6 in., the trailing tires, 15 in. by 5 in.

* * *

Passenger car ends being rebuilt at the Southern Pacific shops, Sacramento, Cal.

(*Turn to next left-hand page*)

High Spots in

Railway Affairs . . .

Army Will Operate a Railroad

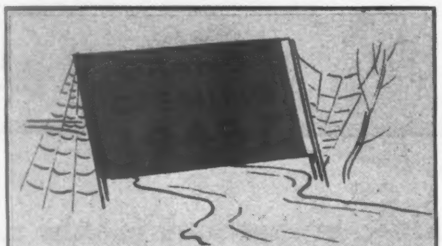
The War Department has secured the Red River & Gulf Railroad a 58.7 mile line in Louisiana, to be used as a sort of "military railway laboratory to test all sorts of wartime operations." The road will be extended to about 86 miles and will operate as does a commercial railway, but using military personnel. The 711th Engineer Battalion (Railway Operating) is being formed to take charge of it. The battalion will consist of about 20 officers and 750 enlisted men. The Army has specially designed, light-weight railway equipment, consisting of 20-ton cars and 30-ton locomotives for use in hastily prepared railways of forward areas; these will be tested as to design, uses and efficiencies. Volunteer requests of engineer reserve officers, with the concurrence of railway management, for extended active duty with the battalion are "being received in adequate numbers." After a brief course at the Engineer School at Fort Belvoir, Va., these officers will serve for one year with the battalion and will then be replaced by another group. A nucleus of enlisted men will be provided by the transfer of individuals who have had railroad experience and who are already in the military service. The remainder of the battalion will come from the Engineer Replacement Training Center at Fort Belvoir.

Statesmanship Required

There can be no question concerning the sincerity of that group of men in Congress who fought so hard to produce a Transportation Act in 1940 that would go a long way toward solving the transportation problem in this country. Despite their efforts, which extended over several years, the Act fell far short of what had been hoped for it. There was a frank admission of this in the provision in the Act for a Transportation Study Board, which is charged with the task of making studies to determine how the various types of carriers "can and should be developed so that there may be provided a national transportation system adequate to meet the needs of the commerce of the United States, of the postal service and of the national defense." It specifically requires, also, that the extent to which the different types of carriers are subsidized should be determined, and that complete facts should be assembled as to the taxes imposed upon them by all agencies of government. The President was slow in appointing the board and Congress none too prompt in approving of it and appropriating funds with which to carry on its activities. The personnel of the board has also been criticized—their comparative youth, the fact that the board is made up of two New Dealers and an "Independent" in politics, etc. Be that as it may, the board is faced with a stupendous assignment, the successful handling of which will mean much to the future prosperity of this country. Or it may be so handled as to pave the way for government ownership of the carriers and lead to the invasion and breaking down of that spirit which has developed the resources of this country and given our people the highest standard of living of any nation in the world—the spirit of private enterprise.

Why Defeat St. Lawrence Waterway

The cartoons shown below are part of a popular educational campaign that is being waged by the Railroad Co-operative League of Michigan. This association is composed of railroad employees and citizens.



It could not possibly be completed before 1945—when the war will probably be ended.

And the billion dollars it would cost Uncle Sam are now badly needed for defense.

It could operate only seven months of the year—it would create no new markets.

Taxpayers Pay For This

The Temporary National Economic Committee, familiarly known as the T. N. E. C. and more generally known as the Monopoly Committee, has been releasing a series of monographs prepared by individuals, and for which, apparently, the committee accepts no responsibility. In one of these monographs, No. 26, entitled, Economic Power and Political Pressure, prepared by two economic experts of the T. N. E. C., there is a chapter on utilities and railroads. In it the statement is made that "estimates of the amount of money spent by the A. A. R. and its numerous subsidiaries on propaganda and lobbying activities are so high as to be almost incredible, running to far over a hundred million dollars for the period since 1918." Donald C. Blaisdell, who wrote this part of the monograph, gave as his authority for this statement an article which appeared in Labor, the weekly newspaper published by the railroad labor organizations.

J. J. Pelley, president of the A. A. R., characterizes the statement in the monograph as "so outrageously unfair and so palpably false that I cannot refrain from calling it to your attention." In great detail Mr. Pelley then shows that expenditures to the extent of some $182,000,000 were made by the railroads from 1920 to 1936 for their association activities, which are done through the medium of committees and various associations. This included work done in connection with the exchange of equipment and the repair and return thereof, including payment for the use of cars delivered to other railroads in exchange; the research work of the associations in the field of equipment and operating methods; formulation of rules for the transportation of explosives and other dangerous articles; the work of demurrage and storage bureaus, which have to do with the making of demurrage rules and the collection of demurrage; investigation and work done for fire protection; and the work of the traffic bureaus, having to do with the investigation of rates and the publication of tariffs. As a matter of fact, over these years the work of the Association of American Railroads, the Association of Railway Executives, the law department of the A. A. R., and the state railroad associations, has not cost more than $8,000,000, and of this only a very small proportion was expended in legislative work, national and state, consisting principally of bills for printing and clerical help and postage. Considering the great amount of money that has been appropriated for the T. N. E. C. and the amount of misinformation it is disseminating, it might be well for the taxpayers associations to look into its activities and check up on its expenditures and the type of so-called "experts" it is using.

(*Turn to second left-hand page*)

NEWS

First Alco-Built Combat Tank Accepted by U. S. Army

On April 19 the first of 685 medium (M-3) combat tanks ordered on November 23, 1940, were tested and turned over, with appropriate ceremonies, to the United States Army by the American Locomotive Company at its plant at Schenectady, N. Y. The tank, built up of armor riveted together, has an overall length of 18 ft. and is over 8 ft. in height and weighs about 28 tons. It is made up of more than 14,000 parts, is armed with machine guns and 75- and 37-mm. cannon, and has a heavily armored rotating turret on top. It is driven by a 400-hp. fan-cooled gasoline engine of radial, aircraft type, located in the rear and is said to be capable of a sustained speed of upwards of 25 miles an hour. Steering is accomplished by hydraulic brakes.

The actual weight of the tank is carried on extraordinarily flexible wheel suspensions, three on each side. Each suspension is supported by two solid rubber-tired wheels and the angle of movement of each pair of wheels is such as to permit the track underneath to bend over practically any obstacle which might be encountered.

In preparing for the building of these tanks many extensive alterations had to be made at the Schenectady plant of the American Locomotive Company. Thousands of square feet of floor space was diverted from the manufacture of locomotives and rearranged for efficient and rapid assembly line production of combat tanks. More than two hundred new machine tools had to be ordered, received and installed, and existing machine tools had to be relocated. Over 2,500 different drawings had to be processed. Three hundred and fifty orders for materials were placed; engines, accessories, transmissions, etc., had to be supplied by the government in addition to armor plate and guns, and many hundred workmen had to be hired and specially trained.

In accepting the tank for the United States Government, Robert P. Patterson, under secretary of war, said: "The record speed of the completion of this tank, fabricated by a commercial facility from new drawing to complete tank again demonstrates the genius of American industry: (1) skilled loyal workmen; (2) trained, energetic leaders in the shop and mill; (3), intelligent, efficient, honest, driving management, and (4) the keen desire of organizations such as the American Locomotive Company to throw their experienced facilities into the job of turning out that which we need for our national defense in record time with high efficiency."

The first of 685 medium combat tanks which are being built by the American Locomotive Company for the United States Army

New Passenger Car Wheel Developed by Armco

A new high-speed passenger-car wheel especially resistant to internal stresses developed in service has been announced by W. W. Sebald, vice-president, American Rolling Mill Company, Middletown, Ohio. The chief factor in the five years of research preceding its production was a testing-machine developed by the company which made it possible to simulate the effect of thousands of actual service miles within several hours. This machine can produce complete failure of wheels due to breaking through the rim and plate as in actual service.

To achieve a wheel having resistance to both low initial stresses and cumulative service stresses, engineers of the company first made metallograph-studies of wheels in service to determine the cause of thermal cracking. They then made a laboratory test on the machine mentioned above of the behavior of every analysis of steel used or proposed for passenger-car wheels. By these methods a composition of steel possessing the properties desired was determined.

Equipment Purchasing and Modernization Programs

Chicago & North Western.—The C. & N. W. has awarded a contract to the H. A. Peters Company, Chicago, for the construction of a one-story machine shop addition 100 ft. by 150 ft. at Green Bay, Wis. The new structure will have a steel frame and brick walls, and a 15-ton traveling crane and two track drop table pits will be installed. The cost of the improvements will be approximately $82,000.

The Chicago, Rock Island & Pacific.—The Rock Island has been authorized by

(*Continued on next left-hand page*)

Orders and Inquiries for New Equipment Placed Since the Closing of the April Issue

Locomotive Orders

Road	No. of Locos.	Type of Locos.	Builder
Atchison, Topeka & Santa Fe	1	5,400-hp. Diesel-elec. frt.	Electro-Motive Corp.
Baltimore & Ohio	4	4,000-hp. Diesel-elec. pass.	Electro-Motive Corp.
Central of Georgia	1	1,000-hp. Diesel-elec.	Baldwin Loco. Wks.
	1	660-hp. Diesel-elec.	
Chicago & North Western	3[1]	660-hp. Diesel-elec.	American Loco. Co.
	3[1]	350-hp. Diesel-elec.	Whitcomb Loco. Co.
Chicago, Burlington & Quincy	5	44-ton Diesel-elec.	Davenport-Besler Corp.
Chicago, Milwaukee, St. Paul & Pacific	1[2]	4,000-hp. Diesel-elec.	Electro-Motive Corp.
	1	5,400-hp. Diesel-elec. frt.	
	1	600-hp. Diesel-elec.	
	2	1,000-hp. Diesel-elec.	American Loco. Co.
	1[3]	4,000-hp. Diesel-elec.	
	2	44-ton Diesel-elec.	Davenport Besler Corp.

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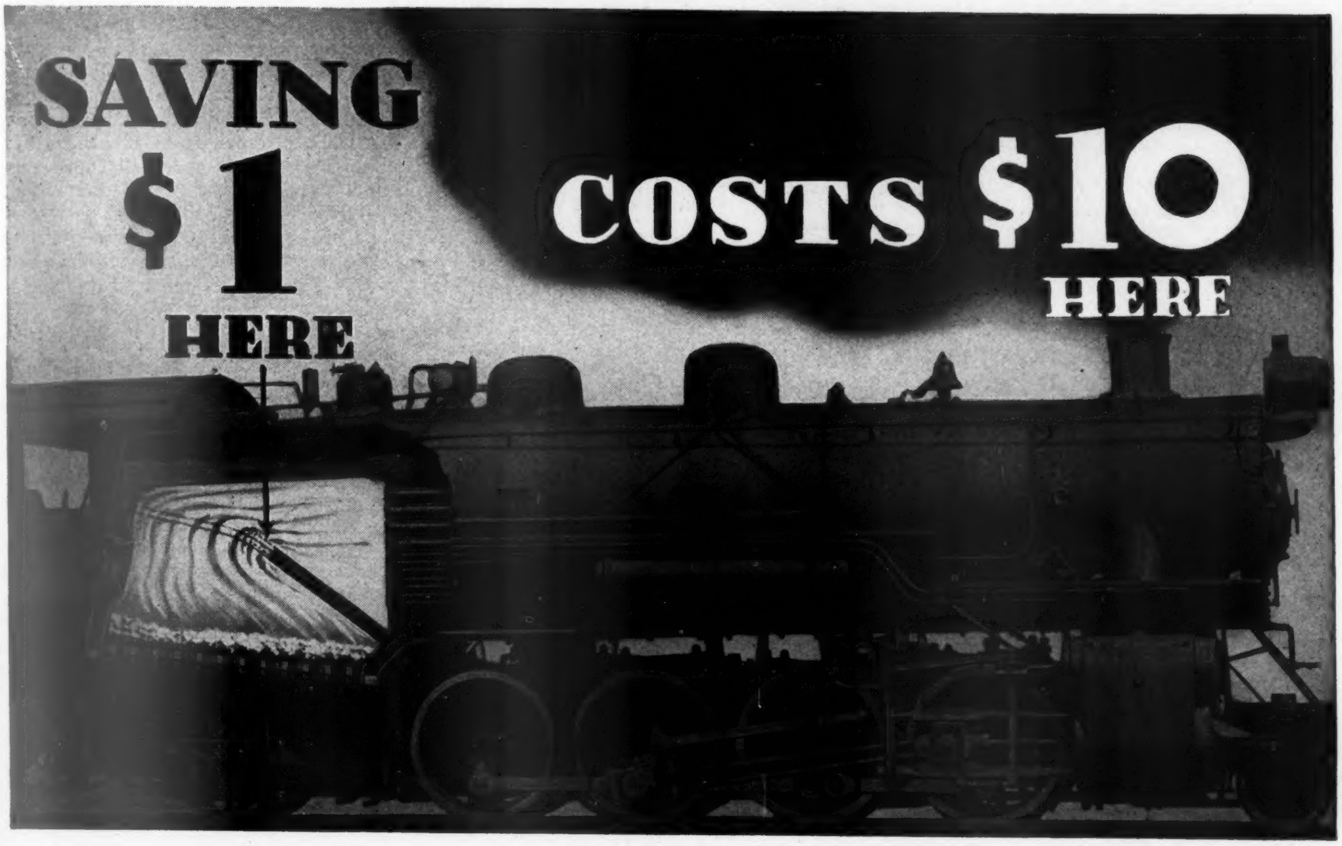

cut down on the arch and you boost the fuel bill

No one questions locomotive Arch economy. The Arch has been so thoroughly proved as a fuel saver by railroad after railroad for years past.

In the urge for money saving don't let the desire to save a few dollars in Arch brick expense, by skimping on the Arch, blind you to the fact that every dollar thus "saved", boosts the fuel bill ten dollars.

The surest way to the lowest operating cost is not in crippling proved economy devices but in making full use of them. This means complete Arches, with every brick in place, for each locomotive that leaves the roundhouse.

HARBISON-WALKER REFRACTORIES CO.
Refractory Specialists

AMERICAN ARCH CO.
INCORPORATED
60 EAST 42nd STREET, NEW YORK, N. Y.
Locomotive Combustion Specialists

Chicago, Rock Island & Pacific	2	2,000-hp. Diesel-elec.	Electro-Motive Corp.
	1	2,000-hp. Diesel-elec.	American Loco. Co.
	5	30-ton Diesel-mech.	Davenport Besler Corp.
Day & Zimmerman, Inc.	1	1,000-hp. Diesel-elec.	Baldwin Loco. Wks.
	1	650-hp. Diesel-elec.	
Denver & Rio Grande Western	1	1,000-hp. Diesel-elec.	Electro-Motive Corp.
Detroit, Toledo & Ironton	2	600-hp. Diesel-elec.	Electro-Motive Corp.
Dewey Portland Cement Co.	1	44-ton Diesel-mech.	Davenport Besler Corp.
Great Lakes Steel Co.	2	600-hp. Diesel-elec.	Electro-Motive Corp.
Minnesota Transfer Ry.	3	360-hp. Diesel-elec.	American Loco. Co.
Newfoundland Ry.	1	2-8-2	Montreal Loco. Wks.
Norfolk & Western	6	Mallet	Co. shops
Pennsylvania	1	1,000-hp. Diesel-elec.	Electro-Motive Corp.
Pickands, Mather & Co.	1	0-8-0	Baldwin Loco. Wks.
St. Louis-San Francisco	2	44-ton Diesel-elec.	Davenport-Besler Corp.
Terminal R. R. Assn. of St. Louis	3	1,000-hp. Diesel-elec.	American Loco. Co.
	2	1,000-hp. Diesel-elec.	Baldwin Loco. Wks.
	3	1,000-hp. Diesel-elec.	Electro-Motive Corp.
United States Navy Dept.	3	300-hp. Diesel-elec.	H. K. Porter Co.

Freight-Car Orders

Road	No. of Cars	Type of Car	Builder
Aliquippa & Southern	50	L. S. Gondolas	Co. shops
Atchison, Topeka & Santa Fe	1,000	50-ton box	Pull.-Std. Car Mfg. Co.
	500	50-ton auto	
	200	50-ton gondola	Gen. Amer. Trans. Corp.
	50	Steel Caboose	Co. shops
Baltimore & Ohio	50[3]	70-ton cement	Greenville Steel Car Co.
	23	70-ton gondolas	Bethlehem Steel Co.
Bethlehem Steel Co.	12	100-ton flat	Co. shops
	3	200-ton ingot	
Central of Georgia	100	50-ton box	Pull.-Std. Car Mfg. Co.
	100	50-ton auto	
Chesapeake & Ohio	400	50-ton hoppers	American Car & Fdry. Co.
	300	50-ton hoppers	Gen. Amer. Trans. Corp.
	300	50-ton hoppers	Pull-Std. Car Mfg. Co.
Chicago, Indianapolis & Louisville	60	50-ton flat	Pull.-Std. Car Mfg. Co.
	150	50-ton box	
Chicago, Milwaukee, St. Paul & Pacific	500	50-ton box	[4]Co. shops
	25	Caboose	
	6	100-ton flat	
Chicago, Rock Island & Pacific	25	70-ton covered hopper	Gen.-Amer. Trans. Corp.
Delaware & Hudson	5	100-ton well	Co. shops
Erie	800	50-ton box	Pull.-Std. Car Mfg. Co.
	100	50-ton furniture	American Car & Fdry. Co.
	100	50-ton auto-box	
	50	70-ton covered hopper	
	250	50-ton hopper	Gen. Amer. Trans. Corp.
	250	70-ton gondolas	Greenville Steel Car Co.
	50	70-ton flat	
General Electric Co.	1	70-ton covered hopper	American Car & Fdry. Co.
Illinois Central	1,000[5]	50-ton hopper	Pull.-Std. Car Mfg. Co.
	500[5]	40-ton box	Gen. Amer. Trans. Corp.
	200[5]	40-ton refrig.	
	100[5]	70-ton covered hoppers	
	500[5]	40-ton box	American Car & Fdry. Co.
	100	50-ton flat	
Lake Superior & Ishpeming	100[6]	50-ton ore	Bethlehem Steel Co.
Louisville & Nashville	500	50-ton hopper	American Car & Fdry. Co.
	500	50-ton box	
	500	50-ton hopper	Pullman-Std. Car Mfg. Co.
	600	50-ton box	
Minneapolis & St. Louis	50	50-ton box	Pull.-Std. Car Mfg. Co.
Montour	300	50-ton hopper	Pull.-Std. Car Mfg. Co.
Nashville, Chattanooga & St. Louis	200	50-ton hopper	Pull.-Std. Car Mfg. Co.
New York Central	1,000	50-ton box	Despatch Shops, Inc.
	1,000	50-ton gondolas	
New York, Chicago & St. Louis	500	50-ton box	American Car & Fdry. Co.
Pennsylvania	50	90-ton container	Co. shops
Reading	500	H. S. gondolas	Co. shops
Southern Pacific	50	70-ton H. S. gondolas	American Car & Fdry. Co.
U. S. Navy	1	Flat	Greenville Steel Car Co.
U. S. Navy Dept.	6	70-ton flat	Haffner-Thrall Car Co.
Wheeling & Lake Erie	500	50-ton hopper	American Car & Fdry. Co.

Freight-Car Inquiries

Road	No. of Cars	Type of Car	Builder
Chicago, Rock Island & Pacific	1,000[7]	50-ton box	....
Norfolk & Western	500-1,000	40-ft.-6-in. 50-ton box	....
	200-500	50-ft.-6-in. 50-ton box	....
Southern Pacific	2,000	Flat	....
Missouri Pacific	100[8]	50-ton auto parts	....

Passenger-Car Orders

Road	No. of Cars	Type of Car	Builder
Atchison, Topeka & Santa Fe	2	Diners	Edw. G. Budd
	1	Lunch-counter-diner	
	5	Mail-bagg.	
	14	Mail-storage	
Chicago, Milwaukee, St. Paul & Pacific	8	Taproom	Co. shops
	8	Coaches	
	2	Coach-baggage	
	2	Diners	
	6	Parlor	
Norfolk & Western	35	Chair[9]	Pullman Co.

[1] Purchase authorized by court. Cost of six locomotives, $289,150.
[2] For use on the Hiawatha.
[3] Order unconfirmed.
[4] Reported in the April issue under Equipment Purchasing and Modernization Program.
[5] The 2,300 freight cars will cost $7,400,000.
[6] In addition to the 100 ore cars ordered in February and reported in the March issue.
[7] Purchase, at a cost of $2,700,000, authorized by Federal District Court.
[8] Inquiry renewed.
[9] These are used all-steel Pullman chair cars which will be converted into passenger coaches. Ten of the cars will be converted by the railroad in its shops and 25 by the Pullman-Standard Car Manufacturing Company. Each reconditioned car will be equipped with 43 walk-over type seats and will have a seating capacity of 86 persons. An electric water cooler, wash basin, and other conveniences will be located at each end of the cars.

the district court to purchase $1,175,000 of equipment as follows: three 2,000-hp. Diesel-electric locomotive ($525,000); five stainless-steel coaches ($350,000); two dining cars ($180,000), and two stainless-steel combination mail-express-baggage cars ($120,000). According to E. M. Durham, Jr., chief executive officer, the new equipment is necessary because of substantially increased patronage of the Rock Island's 15 Rocket trains. Purchase of the three locomotives is reported elsewhere in this issue.

Erie.—The Erie is reported to be contemplating the acquisition of five express cars.

Kansas City Southern.—The K. C. S. is reported to be in the market for from 200 to 225 freight cars comprising 100 box cars of 50 tons' capacity, 50 automobile cars of 50 tons' capacity and 50 to 75 gondola cars of 70 tons' capacity.

Reading.—The Reading has been authorized by the company's board of directors to purchase ten Diesel-electric switching locomotives comprising 2 of 1000 hp., 5 of 600 hp. and 3 of 660 hp.

Union Pacific.—The Union Pacific, to meet its requirements for 500 stock cars, will rebuild and convert certain cars in its own shops.

Author of "Grimshaw's Locomotive Catechism" Dies at 91

Dr. Robert Grimshaw, noted inventor and engineer in the mechanical field, died at Englewood, N. J., on April 9 at the age of 91. Dr. Grimshaw retired at the age of 82 following a career of 60 years in mechanical engineering, during which time he developed a number of technical improvements in the railroad industry. He was also a prolific writer on engineering subjects and was the first editor of the magazine "Power."

His principal writing in the railroad field is the "Locomotive Catechism" which ran through 30 editions, the last being dated 1923. This work is a 958-page handbook of questions and answers concerning practical operation and maintenance of the steam locomotive. Dr. Grimshaw was one of the founders of the American Society of Mechanical Engineers in 1880 and a member of a number of professional societies abroad.

Equipment Depreciation Orders

Equipment depreciation rates for four railroads, including the Illinois Central, have been prescribed by the Interstate Commerce Commission in a new series of sub-orders and modifications of previous sub-orders in No. 15100, Depreciation Charges of Steam Railroad Companies.

Prescribed rates for the I. C. are as follows: Steam locomotives, 3 per cent; electric switchers, 2.82 per cent; Diesel-electric switchers, 3.92 per cent; Diesel-electric road locomotives, 6 per cent; freight train cars, 4 per cent; articulated streamlined passenger train, 8.14 per cent; non-articulated streamlined passenger train, 3.84 per cent; Diesel rail motor cars, 4.85 per cent; all other passenger-train cars, 2.75 per cent; floating equipment, 2.5

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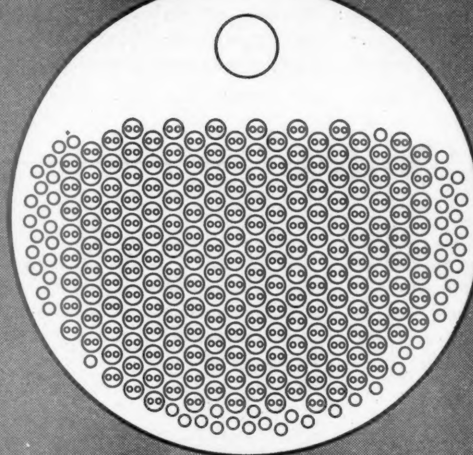
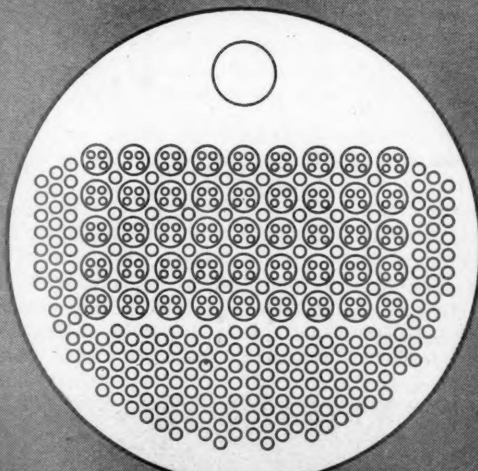
Maximum Boiler Horsepower



Boiler With a Type "E" Superheater

ITEM	SUPERHEATER Type "A"	Type "E"	Increase	Increase Per Cent
Tube and flue heating surface...	4,200 sq. ft.	4,641 sq. ft..	441 sq. ft.	10.5
Superheating surface	1,164 sq. ft.	2,088 sq. ft.	924 sq. ft.	79.3
Gas area	1,337 sq. in.	1,374 sq. in.	37 sq. in.	2.76
Steam area	51.3 sq. in.	67.06 sq. in.	15.76 sq. in.	30.7



Boiler With a Type "A" Superheater

The steam generating capacity of a boiler is directly proportional to the amount of evaporating surface in square feet for equal length of tubes.

The tabulation compares two typical boilers in actual service, with the same outside diameter and length, as illustrated, one designed for the Type "E" superheater and the other for the Type "A" superheater.

The increase in evaporating and superheating heating surfaces made possible with the Type "E" superheater design in the same size of boiler, is substantial and is responsible for an increase in the steam generating capacity of the boiler.

Specify boilers with Elesco Type "E" superheaters for maximum boiler horsepower.

ELESCO

SUPERHEATERS • FEEDWATER HEATERS
AMERICAN THROTTLES • STEAM DRYERS
EXHAUST STEAM INJECTORS • PYROMETERS

THE SUPERHEATER COMPANY

Representative of
AMERICAN THROTTLE COMPANY, INC.
60 East 42nd Street, NEW YORK
122 S. Michigan Ave. CHICAGO
Montreal, Canada
THE SUPERHEATER COMPANY, LTD.

per cent; work equipment, 3.5 per cent; miscellaneous equipment, 12 per cent. The other three roads involved in the present series of orders are the Donora Southern; Genesee & Wyoming; and Lake Erie, Franklin & Clarion.

Rail Employees Advised to File Service Statements

About 300,000 present and former railroad employees who have not yet furnished statements of the railroad service they rendered before 1937 have been advised by the Railroad Retirement Board to file them with the Board or at a railroad office as soon as possible if they wish to avoid delay in getting their annuities at the time they retire and want to help make sure that the necessary records of their pre-1937 service are not lost or destroyed in the future.

In a message directed to these employees, many of whom are not now working for a railroad but who nevertheless have credits toward annuities based in whole or in part on service in the railroad industry before 1937, the Board states: "Your service in the railroad industry before 1937 may be creditable toward your annuity under the Railroad Retirement Act. Under a nation-wide program [the prior service records project] recently authorized by Congress the amount creditable to you for that service can now be determined by the Board in advance of your retirement if you will state when, where, and for whom you worked, so that your railroad employers can furnish the Board with a record of your service and compensation."

Supply Trade Notes

Walter Davis has been appointed west coast representative of the Graham-White Sander Company of Roanoke, Va.

George H. Snyder, sales agent in charge of the St. Paul, Minn., office of the American Steel Foundries, Chicago, has been appointed general sales manager, railway division, with headquarters at Chicago. Mr. Snyder entered railway service in 1905 in the stores department of the Minneapolis, St. Paul & Sault Ste. Marie and in 1911 was transferred to the office of the general mechanical superintendent. He resigned from the M. St. P. & S. S. M. in 1920 to enter the sales department of the American Steel Foundries at St. Paul, and since 1935 has been sales agent in charge of that office.

George H. Snyder

James M. Brophy has been appointed sales representive of the Chicago Railway Equipment Company, Chicago.

American Chain & Cable Co.—*J. E. Skinner* has been placed in charge of welding wire sales, as assistant to W. H. Bleecker, sales manager, at the general sales office of the Page Steel & Wire division, American Chain & Cable Co., Inc. He succeeds *V. H. Godfrey,* who has been called to active duty with the United States Navy. *W. H. Hoagland* of the Chicago office of the Page Steel & Wire division has been transferred to Monessen, Pa., to assume the duties previously handled by Mr. Skinner.

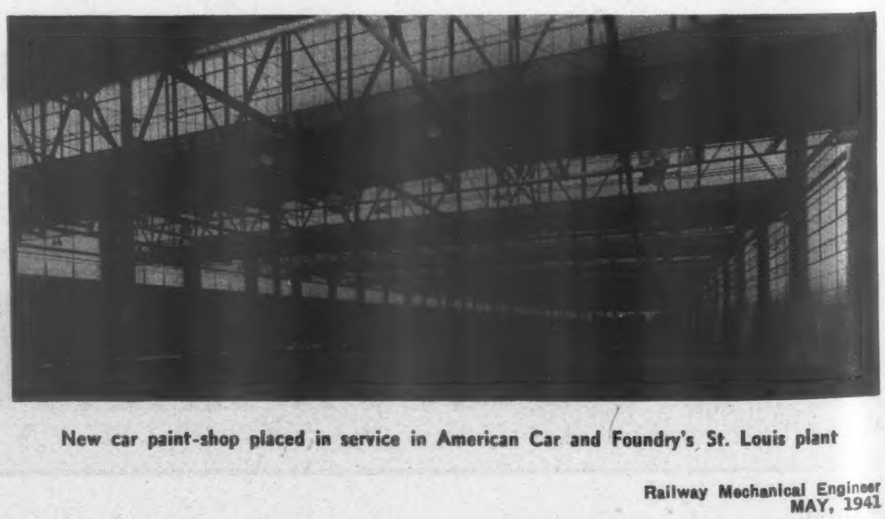
Pittsburgh Plate Glass Company.—*Robert L. Clause,* executive vice-president of the Pittsburgh Plate Glass Company, Pittsburgh, Pa., has been elected president to succeed *H. S. Wherrett,* who has been elected to the newly created office of vice-chairman of the board.

The American Rolling Mill Company is building a new $5,000,000 blast furnace, at the Ashland, Ky., division. Construction began March 12, and is expected to be completed in about one year. Daily operation will require about 1,950 tons of ore, 935 tons of coke, 485 tons of limestone, 125 tons of mill scale and open hearth slag.

American Car & Foundry Company.—At the St. Louis plant of the American Car and Foundry Company a new car paint-shop has recently been placed in service. It contains eight railroad tracks, and accommodates 115 freight cars at one time. Designed for year-round operation, 30 overhead unit heaters will maintain a comfortable 65 deg. F. even in zero weather. The building is 660 ft. long, 130 ft. wide, and contains 86,000 sq. ft. of concrete flooring. Daylight illumination is supplied by 22,000 lights of glass in the walls and in the Aiken type monitor roof, and the electrical illumination is from incandescent lamps in enclosed angle-type reflectors. The two 64-ft. trusses which support the roof give a working clearance of 20 ft. and the entire floor area is free except for one central row of steel columns.

M. A. Foss, service engineer of the Locomotive Firebox Company, Chicago, has been appointed assistant vice-president, with headquarters in New York. He will assume the duties in the Eastern territory formerly performed by George N. DeGuire deceased. Mr. Foss received his early training in the employ of the Bath Shipbuilding Company, Bath, Me., and was in charge of the boiler department of that company from 1917 to 1921. In the latter year, he became supervisor of boilers and maintenance of the New York, New Haven & Hartford, and in 1929 entered the employ of the Locomotive Firebox Company as service engineer.

M. A. Foss



New car paint-shop placed in service in American Car and Foundry's St. Louis plant

E. P. Barnett has joined the Hunt-Spiller Manufacturing Corporation of Boston, Mass., as sales representative in the southeast territory assisting F. B. Hartman. Mr. Barnett had been assistant mechanical engineer on the Southern from 1935 to 1940 and, during the past year was a special engineer on the Chicago, Indianapolis & Louisville.

◆

American Car and Foundry Co.—*Thomas A. Dooley* has been appointed district manager in charge of the Madison, Wis., and St. Louis, Mo., car plants of the American Car and Foundry Company which have been combined under the one management. *Norman H. Shipley* will act as assistant district manager of the Madison car plant.

◆

Harry E. Orr, for the past seven years chief metallurgist of the Burnside Steel Foundry Company of Chicago, has been appointed sales engineer of the Vanadium Corporation of America, with headquarters at the company's Chicago office.

◆

Frank S. Williams has been placed in charge of eastern sales for the Wilson Engineering Corporation, Chicago, with headquarters at Providence, R. I. Since graduation from Yale University in 1914 he completed a special apprenticeship course in the shops of the Colorado & Southern and has served the Union Pacific, the Denver & Rio Grande Western and the Chicago, Rock Island & Pacific as transportation inspector.

Obituary

Fred J. Wilson, who until his retirement in 1935 had handled sales of the locomotive equipment division of Manning, Maxwell & Moore, Inc., on the Pacific coast, died April 3 at his home in Alhambra, Cal.

Personal Mention

General

Dean F. Willey, mechanical superintendent of the New York, New Haven & Hartford, with headquarters at New Haven, Conn., has been appointed general mechanical superintendent, succeeding Albert L. Ralston, deceased.

Master Mechanics and Road Foremen

Fred L. Carson, master mechanic on the Southern Pacific Lines in Texas & Louisiana at San Antonio, Tex., has retired.

L. J. Gallagher, general master mechanic on the Northern Pacific, Western district, with headquarters at Seattle, Wash., has retired.

H. H. Jones, assistant to the superintendent of motive power and machinery of the Union Pacific at Pocatello, Idaho, has been appointed master mechanic at Los Angeles, Calif.

P. T. Briers, master mechanic of the Cincinnati division of the Chesapeake & Ohio, at Stevens, Ky., has been transferred to the Richmond (Va.) division, to succeed J. S. Williams, deceased.

Grant W. Stanton, traveling engineer of the Minneapolis, St. Paul & Sault Ste. Marie, has been promoted to master mechanic, with headquarters as before at Minneapolis, Minn.

Arthur H. Fiedler, master mechanic on the Northern Pacific at Jamestown, N. D., has been appointed general master mechanic, Eastern district (Lines east of Livingston, Mont.), with headquarters at St. Paul, Minn.

G. L. Ernstrom, general master mechanic on the Northern Pacific, Eastern district (Lines east of Livingston, Mont.), at St. Paul, Minn., has been transferred to the Western district, with headquarters at Seattle, Wash.

Jesse A. Cannon, road foreman of engines on the Northern Pacific at Minneapolis, Minn., has been promoted to the position of master mechanic at Jamestown, N. D.

J. E. Goodwin, general foreman of the locomotive shop on the Missouri Pacific at North Little Rock, Ark., has been appointed master mechanic on the International-Great Northern (Missouri Pacific) with headquarters at San Antonio, Tex. Mr. Goodwin was born May 13, 1902, at Topeka, Kans., and attended high school at Newton, Kans., and received his technical education at Lake Forest University and the University of Chicago. He entered railway service in June, 1917, with the Atchison, Topeka & Santa Fe at Newton as a messenger. After having served his apprenticeship in the locomotive shop with the Santa Fe, Mr. Goodwin became machinist in January, 1922, from which position he resigned to enter college. In June, 1925, he joined the Missouri Pacific at Hoisington, Kans., as a machinist and in March, 1926, was transferred to Horace, Kans., as enginehouse foreman. In November, 1927, he became erecting foreman at North Little Rock, Ark., November, 1929, schedule supervisor; December, 1930; general foreman, November, 1933; and served in this capacity until appointed to his present position.

J. E. Goodwin

C. D. Allen, assistant master mechanic on the Chesapeake & Ohio at Clifton Forge, Va., has been promoted to master mechanic of the Cincinnati division, with headquarters at Stevens, Ky.

Paul E. Leonard, enginehouse foreman on the Southern Pacific Lines in Texas & Louisiana at Beaumont, Tex., has been promoted to master mechanic at San Antonio, Texas.

J. J. Callaham, road foreman of engines on the Chesapeake & Ohio at Huntington, W. Va., has been appointed trainmaster and road foreman of engines, with headquarters at Huntington, covering territory west of Peach Creek, W. Va., succeeding C. L. Gilmore, retired.

Car Department

Frank E. Cheshire, general car inspector, Missouri Pacific, who has been promoted to the newly created position of assistant superintendent car department, as announced on page 168 of the April issue of the *Railway Mechanical Engineer*, was born on April 27, 1898, at Cumberland, Md. Mr. Cheshire attended the Keyser W. Va., high school, Potomac State College, and Davis-Elkins College. He entered railway service on May 28, 1915, with the Baltimore & Ohio. In June, 1916, he enlisted in the Army holding warrants as corporal, sergeant and sergeant first-class. He was commissioned second lieutenant in August, 1918, and first lieutenant in September, 1918. In July, 1919, he resigned, and in

Frank E. Cheshire

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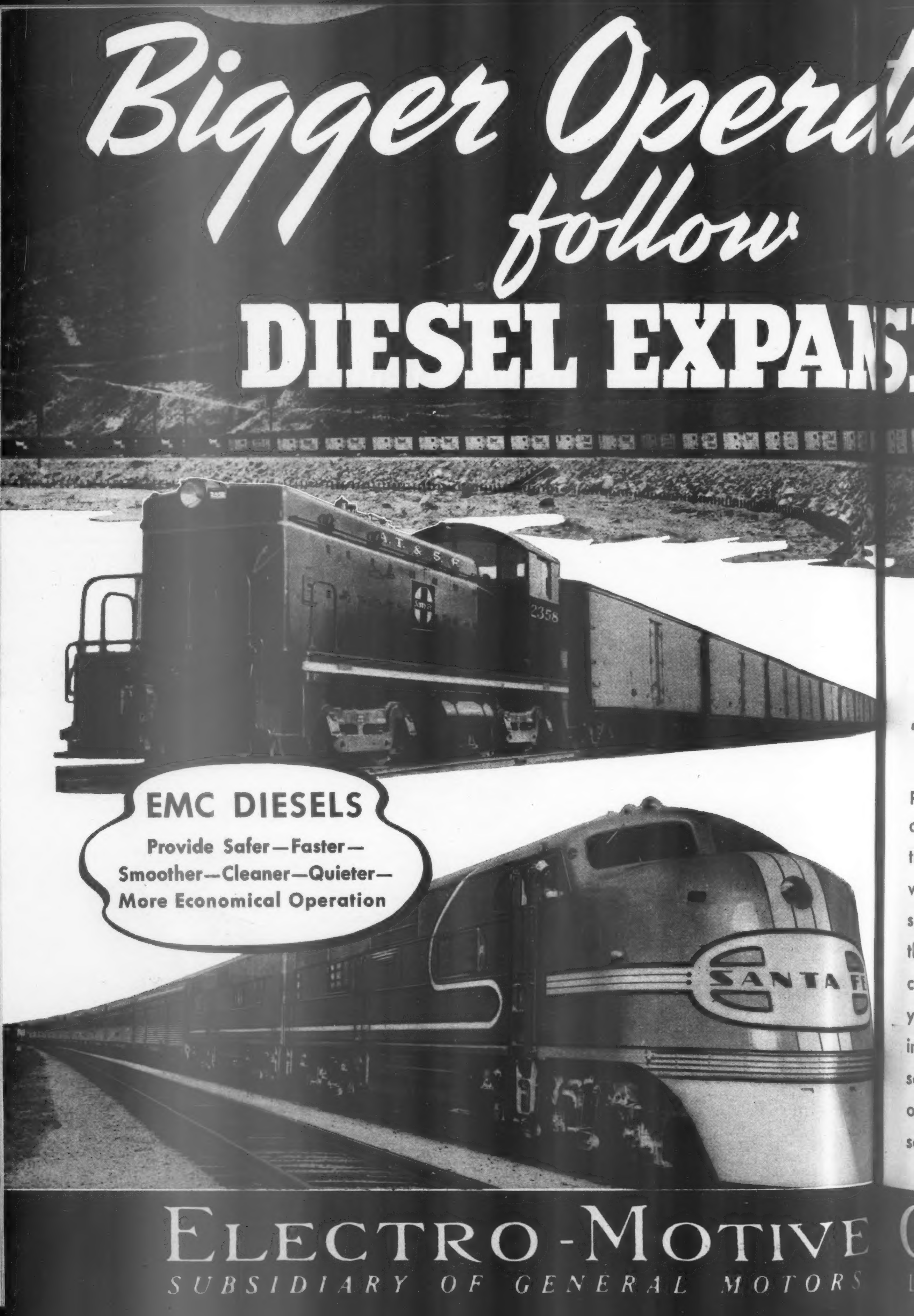
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January, 1920, returned to the B. & O., serving subsequently as car builder, car inspector, work checker, traveling car repair accountant, shop foreman, and car foreman. He was with the Ford Motor Company for a few weeks in 1926, in July of which year he entered the service of the Missouri Pacific as assistant general car inspector. On July 1, 1927, he became general car inspector. Mr. Cheshire is active in American Legion activities having served four terms as post commander, district commander and department chairman on Americanism. He holds a commission as major, Engineers Corps Reserve, assigned to headquarters, Military Railway Service. He is a past president and chairman, Executive Committee, of the Car Department Officers' Association of St. Louis. Mr. Cheshire is now vice-president of the Car Department Officers' Association.

J. B. Harmison has been appointed division car foreman on the Erie with headquarters at Jersey City, N. J.

C. W. Graham, car shop superintendent of the Wabash, has been appointed assistant superintendent of the car department, with headquarters as before at Decatur, Ill.

O. A. Wallace, general car foreman of the Atlantic Coast Line, with headquarters at Wilmington, N. C., has been appointed superintendent of the car department.

J. M. Holt, general car inspector of the Southern Pacific (Pacific lines), has been promoted to general master car repairer, a newly created position, with headquarters as before at San Francisco, Cal.

Shop and Enginehouse

W. A. Newman, general foreman on the Chicago, Burlington & Quincy at Denver, Colo., has been promoted to assistant superintendent of shops, a newly created position, with headquarters at West Burlington, Iowa.

Purchasing and Stores

Frank Cary Holton, assistant superintendent of motive power of the Virginian at Princeton, W. Va., has been appointed purchasing agent with headquarters at Roanoke, Va. Mr. Holton was born on December 19, 1896, at Danville, Va., and was educated at the Danville elementary school, Danville Military Institute, Virginia Polytechnic Institute and Cornell University (1918). During the summers of 1910 to 1913, Mr. Holton served as a machinist apprentice on the Southern at Danville and during the summers of 1914 to 1918, was a machinist apprentice on the Norfolk & Western at Roanoke, Va. He became an ensign in the United States Navy in 1918, and in 1919 returned to Roanoke as a machinist on the Norfolk & Western. He entered the service of the Virginian in 1920 as mechanical inspector and enginehouse foreman at Princeton, W. Va. Mr. Holton was appointed chief draftsman at Princeton in 1924, mechanical engineer in 1927, and assistant superintendent of motive power in 1938.

Obituary

Albert L. Ralston, general mechanical superintendent of the New York, New Haven & Hartford, with headquarters at New Haven, Conn., died on April 3 in Pinehurst, N. C., where he was on vacation. Mr. Ralston was born at Amo, Ind., on April 10, 1883, and was graduated from Purdue University in June, 1905, following which he took a special apprenticeship course with the Westinghouse Electric & Manufacturing Company at Pittsburgh, Pa., specializing in railroad work. During 1906 and the early part of 1907 he worked in the engineering department of Westinghouse on the development of design and construction of the first electric locomotive built for the New Haven, then being assigned by Westinghouse to Stamford, Conn., where he remained until 1914. Mr. Ralston entered the service of the New York, New Haven & Hartford as assistant electrical engineer in May, 1914, and in February, 1915, was appointed assistant to the mechanical superintendent in charge of the maintenance of electric equipment. In May, 1917, he became engineer of electric traction, with headquarters at Grand Central Terminal, and in September, 1918, he was promoted to mechanical superintendent in charge of maintenance of electric equipment, remaining in that position until his promotion to assistant general mechanical superintendent at New Haven on November 1, 1932. Mr. Ralston was promoted to general mechanical superintendent in July, 1934.

Albert L. Ralston

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers. State the name and number of the bulletin or catalog desired, when it is mentioned.

Arc Welding.—The Hobart Brothers Company, Troy, N. Y. "Arc Welding Manual and Operator's Training Course." Price, fifty cents. Practical lessons in arc welding taken from Part II of large Hobart book, "Arc Welding and How To Use It."

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Mechanical Stokers. — The Standard Stoker Company, Inc., 350 Madison avenue, New York. Publication No. 69—a photographic tour of The Standard Stoker Company's plant and its facilities for the manufacture of mechanical stokers for coal-burning locomotives; coal pushers for locomotive tenders, and stokers for certain types of marine use.

◆

Grinding Wheel Dressing Tools.—Koebel Diamond Tool Co., 9350 Grinnell avenue, Detroit, Mich. "Meet Joe Green, Grinder Hand," is a four-page brochure for Management in industry which has the responsibility of furnishing men with suitable tools and teaching them their proper use. "For (Grinder) Men Only," a 28-page booklet enclosed with the brochure, is a handy wheel dressing manual for distribution among grinder operators. It tells by simple word and drawings how to handle the diamond tool so it will give maximum service and is amusingly illustrated.

◆

Bus and Car Washer.—Whiting Corporation, Harvey, Ill. Eight-page illustrated bulletin. Describes Whiting line of bus and car-washing machines. Electrically operated brushes with water sprays clean the cars as they pass through the machine.

◆

Tube Expanders and Tube Cutters.—The Gustav Wiedeke Company, Dayton, Ohio. Folder 355-A shows some Wiedeke Ideal tube expanders and tube cutters for locomotive, water-tube and return-tubular steam boilers. Catalog No. 57 illustrates full line of Ideal tube expanders and cutters.

◆

Unit Truck.—Unit Truck Corporation, 140 Cedar street, New York. Four page illustrated folder descriptive of Unit truck on which the customary brake hangers, brake-beam supports, and adjusting devices are replaced by integral brake-beam guides.

◆

Metal Shaping Machines. — Continental Machines, Inc., 1301 Washington avenue South, Minneapolis, Minn. Spiral bound booklet containing specification sheets on various Doall contour metal-shaping machines for apprentices and those engaged in training programs.

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Fabrication of Stainless Steels.—Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Twenty-eight page Blue Sheet of general suggestions on the welding, machining, riveting, etc., of Allegheny stainless steels.